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Volume 56 Number 8

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IN THIS ISSUE

A NEW LOOK AT A TISSUE IRRITANT DRUG---323

INFECTIOUS PUSTULAR VULVOVAGINITIS IN DAIRY CATTLE---333

RABIES IN THE DOMESTIC CAT---339

A PRACTITIONER'S APPROACH TO RESISTANT BOVINE MASTITIS---355

MANAGEMENT OF RETAINED PLACENTA---356

Complete Index on Page 7a

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GENERAL FEATURES

Clinical Applications of a Sclerotherapeutic Agent, *C. J. Bierschwal, E. F. Ebert* 323
Infectious Pustular Vulvovaginitis in a Pennsylvania Dairy Herd, *D. C. Kradel, R. F. Solorzano, H. W. Dunne, R. L. Michel* 333
An Effective Non-Antibiotic Treatment for Bovine Mastitis, *Thomas R. Slaughter* 355
Management of Bovine Retained Placenta, *L. S. Nilsson* 356
Guest Editorial: Needed—Veterinary Parasitologists *Wendell Krull* 359
Benzethonium Chloride for Inactivation of Erysipelas Organisms, *Fred Zuschek, N. K. Jungk, C. G. Boylan* 363

PET PRACTICE

Rabies in the Domestic Cat, *D. C. Blenden* 339
A Medicated Aerosol for Treatment of Microsporum canis, *E. J. Foley* 342
Therapeutic Management of Acetabular Dysfunction, *Robert D. Brandt* 346
Immobilization of Captive Wild Animals, *Werner P. Heuschele* 348

REGULAR DEPARTMENTS

News Comment 9a
Research Topics 12a
Equine Practice 337
Small Animal Clinic 352
Medical Interchange 367
Practitioner's Bookshelf 29a
Reader's Service 32a

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Therapeutics

Clinical Applications Of A Sclerotherapeutic Agent

C. J. Bierschwal, D.V.M., M.S.
E. F. Ebert, D.V.M.
School of Veterinary Medicine
University of Missouri, Columbia, Mo.

Sclerotherapy is a relatively new contribution to veterinary medicine by European clinicians. In the United States, veterinary sclerotizing agents have been employed chiefly in the treatment of equine supra-scapular paralysis (sweeney) to fill out the atrophied area. Various drugs have been injected, which include turpentine, iodine, phenylmercuric nitrate and silver nitrate. All of these drugs are hyperirritants, and sterile abscessation is not an uncommon sequela. Proctologists employ sclerotic agents in the treatment of internal hemorrhoids and prolapse of the rectum[1]. The agent commonly used is a solution of 5% phenol and 5% menthol in almond oil.

European clinicians have in recent years introduced sclerotherapy in veterinary practice by employing a sclerotic agent to correct such conditions as prolapse of the vagina[2, 3] and rectum; hernia and fistula; milk incontinence; and for sterilization of male animals[4]. This contribution was brought about by the discovery of a new sclerotherapeutic agent Dondren (Knoll Pharm. Co., Orange, N. J.). In contrast to older sclerotic drugs, Dondren is a sterilized mineral oil freed of hyperirritants, packaged in a multiple-dose 100 cc. vial. The drug produces a mild acute inflammation of short duration when injected into connective tissue. This is followed by a chronic inflammation which results in formation of new connective tissue. The new tissue tends to thicken and strengthen the supportive structure.

When Dondren is injected into normal connective tissue, there is an almost immediate reaction. The tissue hypertrophies almost immediately. The enlargement seems

Figure 1.

to reach a maximum within an hour. There is a mild erythema accompanied by an edema. The reaction passes from the acute stage in a matter of hours. A cicatrix forms with its typical hard fibrous formation in 7 to 10 days post-injection. Members of the clinical staff at the School of Veterinary Medicine, University of Missouri, have made numerous injections of the drug with very reliable results.

Histologic examination of the Dondren-stimulated tissue growths shows nests of granulation tissue around fat droplets. Peripherally there is a wall of fibrous connective tissue cells with some fat-storing giant cells. The granulation tissue is well supplied with capillaries. The aseptic inflammation produced is nonspecific.

Vasectomy

With the advent of artificial insemination of beef cattle, it has been advantageous to employ a sterile male bovine to identify females in estrum. Dondren has been used very effectively to sterilize the bull. The technic is simple and easily carried out. The procedure may be performed with the animal restrained in a chute equipped with a body squeeze and accessible from the lower side.

Technic: After the bull has been restrained in the chute, the scrotum is scrubbed with soap and water. A suitable skin antiseptic of choice is applied to the ventral third of the scrotum. The testicle is forced down into the scrotum as far as possible. This allows easy access to the tail of the epididymis and its outline is easily recognized. A 5 cc. syringe is filled with Dondren and a 20 gauge 1½ inch hypodermic needle is attached. The hypodermic needle is forced through the scrotum, tunica vaginalis and deep into the tail of the epididymis. The needle is inserted in a lateral to medial direction. The plunger of the syringe is depressed and at the same time the needle is slowly withdrawn, depositing ¾ cc. to 1 cc. of Dondren (Fig. 1). This procedure is repeated 3 to 4 times in the tail of each epididymis. It is advantageous to have an assistant hold the testicle, leaving the surgeon's hands free to inject and palpate the structure being in-

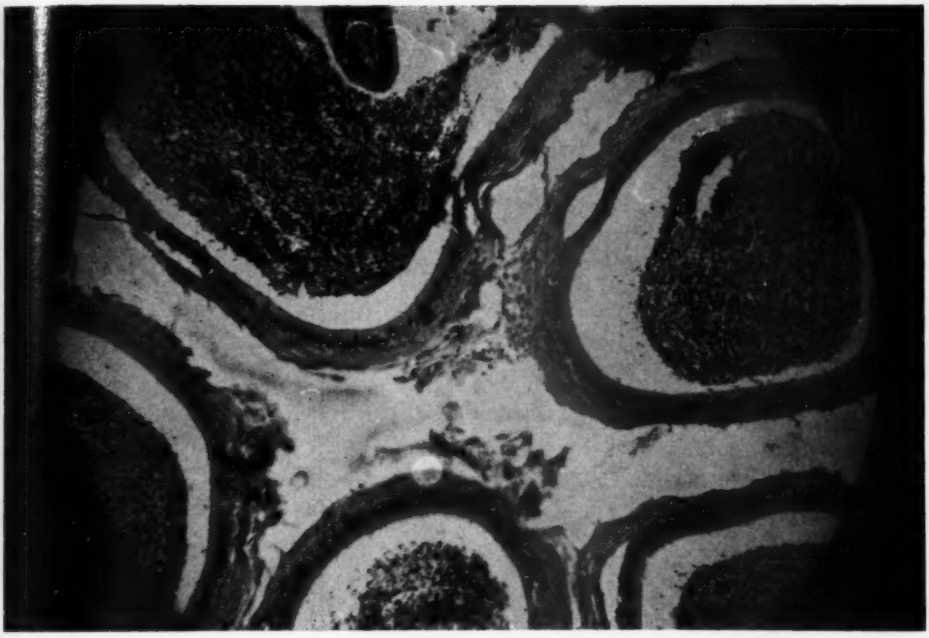


Figure 2.

jected. The basis for success using Dondren in sterilizing the animal is that the ductus epididymis is a long, folded, single tube. If that duct is closed at any one point, sperm cannot be ejaculated, but spermatogenesis can still continue normally. The dosage of Dondren is 2 cc. to 3 cc. in the tail of each epididymis for smaller bulls (500 lb. to 800 lb.) and 4 cc. in each epididymis for larger bulls.

Results: Six young bulls were used experimentally to determine the correct dosage of the drug and its action on the tissue. Within 5 to 10 minutes following injection of Dondren there was a noticeable enlargement of the involved tissue, characterized by a mild erythema and edema of the injected area. The hypertrophy of the injected tissue reached a maximum within 1 to 2 hours. Histological sections made 5 days post-injection revealed the coiled duct of the epididymis almost completely destroyed and replaced with granulomatous tissue consisting of fat droplets (Dondren) surrounded by giant cells, macrophages and extensive connective tissue. Figure 2 illustrates a normal section of the tail of the epididymis. Figure 3 illustrates a Dondren-injected eqididymis 5 days post-injection. None of the animals treated showed noticeable discomfort or pain after the procedure was completed, nor was the area sensitive to the touch after 3 days. A cicatrix was formed 7 to 10 days post-injection. Figure 4 illustrates the gross appearance and Figure 5 is a histologic section of the injected area 12 days post-injection.

Semen samples were taken prior to the injection and every 3 days post-injection until there was absence of sperm. After sterile semen was produced, the bulls were ejaculated at least once a month for 5 months. Semen samples taken from treated animals 3 days post-injection revealed a marked decrease in sperm number and percentage of live sperm. Fourteen to 21 days were required before total absence of sperm was observed. The semen appeared infertile by the 7th or 8th day, and it is doubtful if conception could occur at this time. The German investigator Dorn[4] reported sterilization was complete in 7 days. It is recommended that the bull should be kept separated from the cow herd for a month post-

Figure 3.

Figure 4.

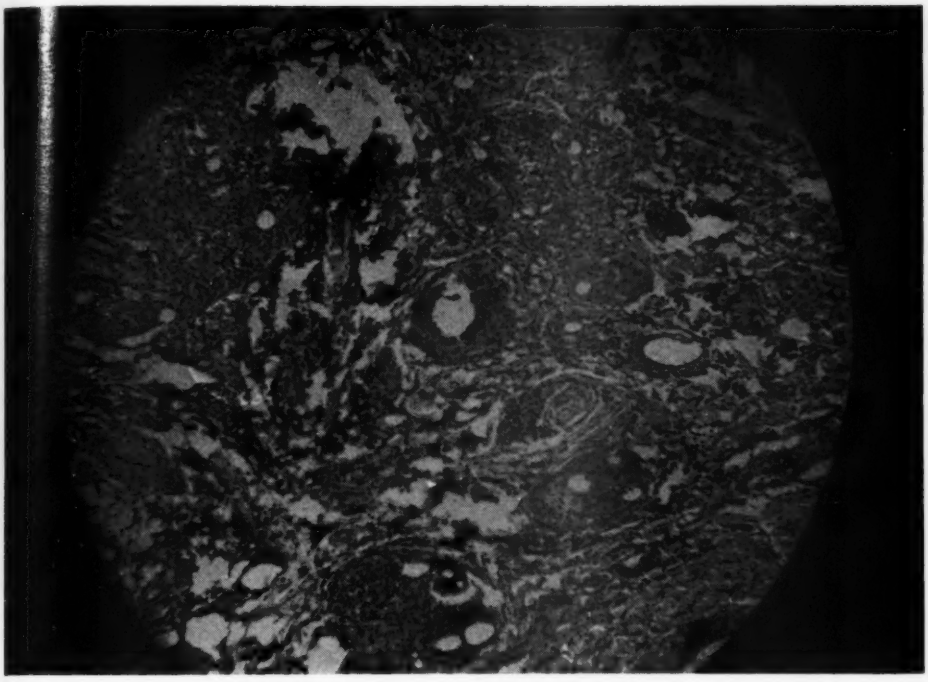


Figure 5.

injection. The bull should be ejaculated and its semen examined before placing the animal with the herd.

In addition to the 6 experimental bulls, 8 animals have been sterilized with Dondren. Without exception, every animal has yielded semen with absence of sperm within 26 days post-injection. Six of the bulls have been used as "teasers" in cow herds with excellent results.

Based on findings in a limited number of animals, Dondren can be recommended as a simple effective method of sterilizing bulls. Four yearling boars have also been sterilized by the same technic with comparable results.

Umbilical Hernia Repair

One of the main uses of Dondren in the equine has been in repairing small umbilical hernias. Numerous cases of umbilical hernias have been referred to the Veterinary Clinic for surgical repair. Those that are large need to have support to the ventral abdominal wall to insure adequate healing. Plastic wire mesh has been inserted between the peritoneum and muscular wall, then sutured. Generally, the results have been good. The majority of hernias however have been small and can be repaired successfully by injecting the hernial ring with Dondren. The suspended skin flap is sutured close to the belly wall with a heavy suture that will impair circulation to the flap of skin and cause a necrosis at the suture line. The skin will slough in 2 weeks or more. The animal should be fasted for 24 hours before the procedure, and sedation produced with a tranquilizer, Sparine, (Wyeth Laboratories) given intravenously at the rate of 0.25 mg. per lb. of body weight. The horse is then left in the stall for 20 minutes before administering 6% chloral hydrate solution intravenously to effect. The animal is cast, tied and rolled to dorsal recumbency. The area over the hernia is clipped free of hair, scrubbed with a neutral soap and water and

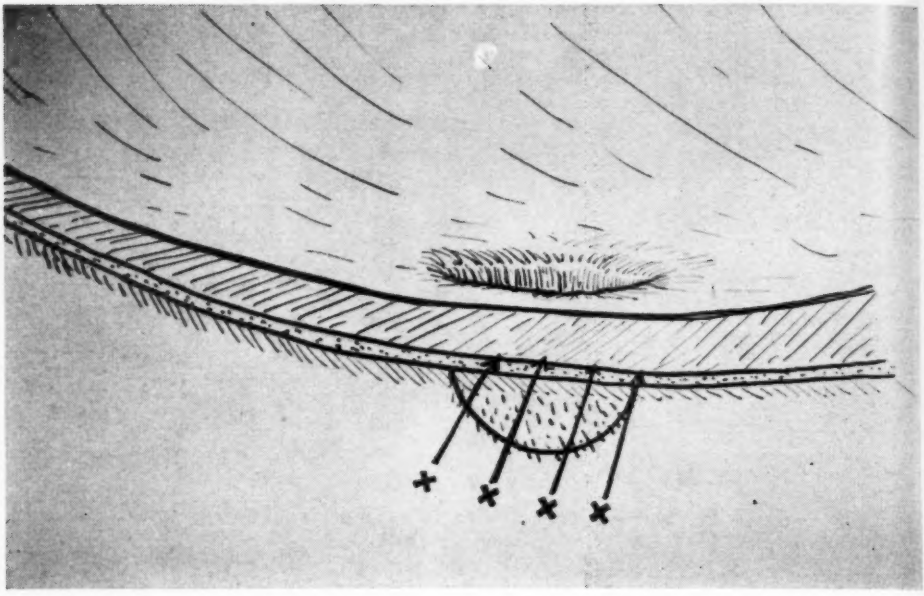


Figure 6.

a suitable skin antiseptic is applied. With the horse on its back, the hernia can be readily reduced with the fingers. Using a sterile 10 cc. glass syringe and a 19 gauge 1½ inch needle, Dondren is injected into the wall forming the hernial ring. With the forefinger of the left hand holding the hernia in the abdominal cavity, the needle may be directed into the matrix of the ring. The needle must be in the wall and not through it. Inject approximately 1 cc. into about 4 locations around the ring. Figure 6 illustrates sites of injection. The operator can feel the results in the swelling of the tissue. Next, the flap is sutured in the conventional manner, using an extra heavy Vetafil (Bengen Co.) or umbilical tape. All sutures must be tight enough to impair circulation. No aftercare is necessary.

Tetanus antitoxin is usually given as a matter of routine precaution. The sclerotherapeutic agent, Dondren, will maintain a closure of the ring. Suturing of the skin flap prevents further herniation and healing is usually uneventful in about 30 days. The skin flap will usually slough in about 2 weeks. Sometimes it is necessary to remove a small portion surgically, but it is best to let nature take its course and not try to hurry the reaction. Figure 5 illustrates the injection of Dondren. This technic has been used on 14 cases and results in all cases were most gratifying.

Prolapse of Bovine Vagina

Dondren has been used in the correction and as supportive therapy in 19 cases of chronic prolapse of the vagina of the bovine. In 10 of the animals the prolapse had been replaced 4 times or more. The remaining cases had at least 1 recurrence of prolapse of the vagina. Of the 19 cases, 16 were partial vaginal prolapses involving the ventral floor or lateral walls of the vagina and 3 were complete prolapse of the vagina.

Technic: Prior to the injection of Dondren, an epidural anesthetic is administered, usually by an in-place catheter method.[5] Six to 10 cc. of 2% procaine or lidocaine is infused through the tubing into the epidural space. Materials used for the injection of the drug are: a 14 to 18 inch length of ⅛ inch diameter rubber tubing with a syringe adapter at one lumen of the tubing and a needle adapter at the opposite lumen; an

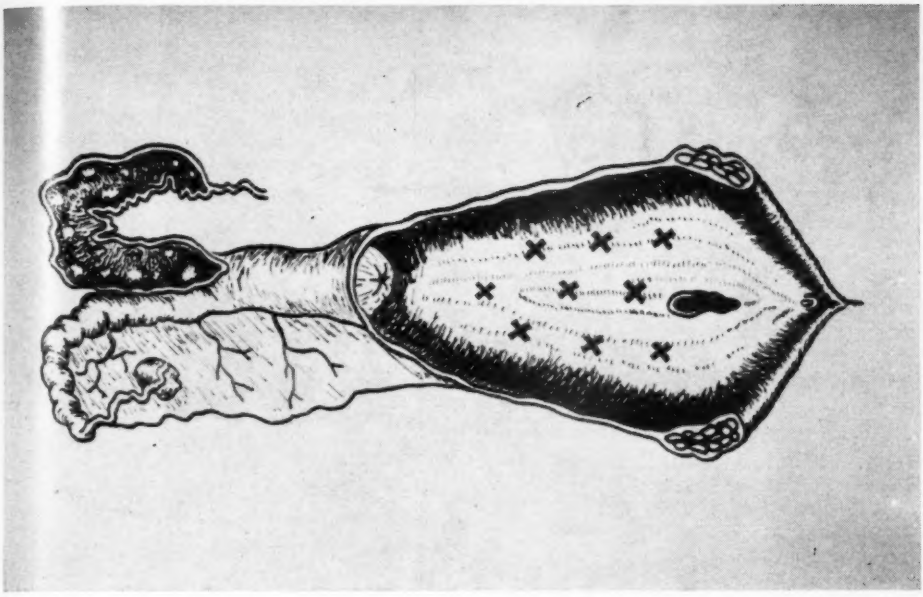


Figure 7.

18 to 20 gauge 2 inch hypodermic needle and a sterile 20 cc. ranch record or glass syringe.

Correction of the chronic, incomplete vaginal prolapse consists first in manually reducing the prolapse if necessary, although most cases of this type reduce spontaneously following epidural anesthesia. The portion of vagina affected is identified by its leathery, hardened texture and its flaccidity. The 20 cc. syringe is filled with Dondren and the plunger depressed until the tubing is filled. The needle and tubing are introduced into the vagina with one hand and the drug is injected in a checkerboard-like pattern in deposits of 3 to 4 cc. each. The needle is introduced into the vaginal mucosa and inserted at a slight angle to a depth of approximately 2 inches or to the hub of the needle. As the syringe plunger is being depressed, the needle is slowly withdrawn. The site of injection is compressed with the finger for a short time. The deposits are made in the affected area and around its immediate border. With regard to the amount of Dondren injected at each site, one should bear in mind that results do not increase in proportion to the amount of Dondren used. The sites of injection are best illustrated by Figures 7 and 8. Figure 7 illustrates the sites of injection used for correction of incomplete prolapse of the vagina involving the central floor. Figure 8 illustrates the sites of injection used for involvement of the lateral wall of the vagina. The chief drawback to this technic is obvious, since the surgeon works without the guidance of his eyes and depends entirely on feeling with the hand. We have not been successful in finding a speculum that will permit adequate dilatation of the vagina to permit the injection of Dondren by sight.

Aftercare following the injection of Dondren is of paramount importance. If the animal has been exhibiting symptoms of tenesmus prior to treatment, stay sutures should be applied to the perivulvar area. The stay sutures are usually left in place 3 to 5 days. If subsequent injections of Dondren are required, they are made about a week after the initial treatment. The vinyl in-place tubing in the epidural space may be used to control tenesmus if it is or becomes a problem.

Chronic cases of vaginal prolapse are

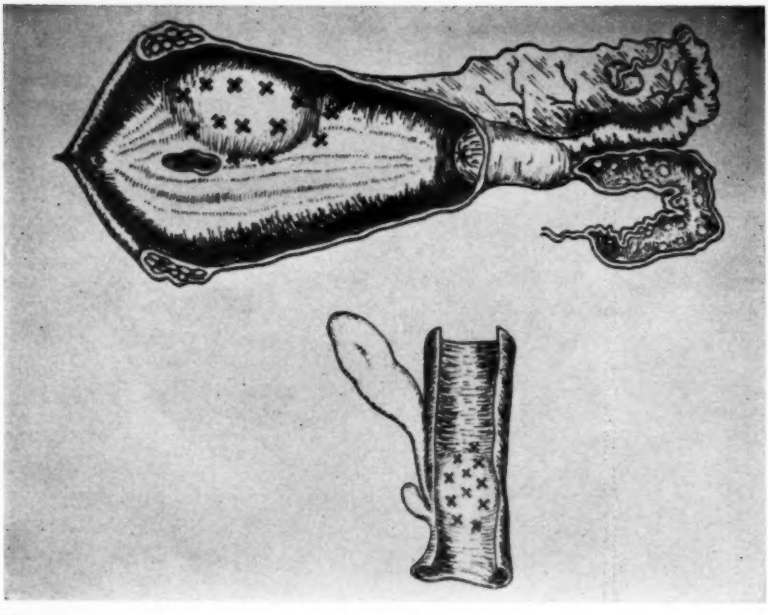


Figure 8.

often accompanied by a flaccid condition of the vulvar labia. The vulva does not seal properly and a pneumovagina follows. This allows contamination of the vagina with feces, urine and air, causing a severe vaginitis accompanied by tenesmus, which causes a chronic intermittent prolapse of the vagina. The condition is corrected by suturing of the scarified vulvar lips, as in the Caslick operation in the mare.[6] The mucosa of the outer ½ to ¾ inch of the vulvar lips is scarified from the dorsal commissure to the level of the ischial arch. Interrupted sutures should be placed about ⅜ to ½ inch apart. If the vulvar opening is small after this operation, artificial insemination may be necessary. The vulva should be incised along the original suture line in the last week or two of gestation. The surgery is repeated after parturition following the passage of the placental membranes. It has been observed that pneumovagina commonly accompanies chronic prolapse of the vagina. The combination of Dondren injections and Caslick-like surgery has given excellent results.

Results: Of the 19 cases in which the sclerotic agent Dondren was used, 9 of the cases recovered after 1 treatment, 4 of the animals recovered after 2 treatments and the 6 remaining animals failed to respond to treatment. It is important to note that combined Dondren treatment and Caslick-like surgery corrected 8 of 10 cases. The use of Dondren for the correction of chronic prolapse of the vagina, especially partial prolapse, has proven to be far superior to surgical correction.

Wry Tail

"Wry Tail" is a condition in American Saddle Horses where the tail rises and then pulls to one side instead of dropping straight down from the dorsal curvature. Dondren injections have been used to correct this condition.

Using a sterile technic, a series of Dondren injections are made into the coccygeal muscle on the side opposite the wry tail curvature (the convex side). One cc. injections are made at approximately 1 inch intervals deep into the muscle. The number of injections needed depends upon the extent of the deviation. Usually 5 or 6 injections are required. Figures 9 and 10

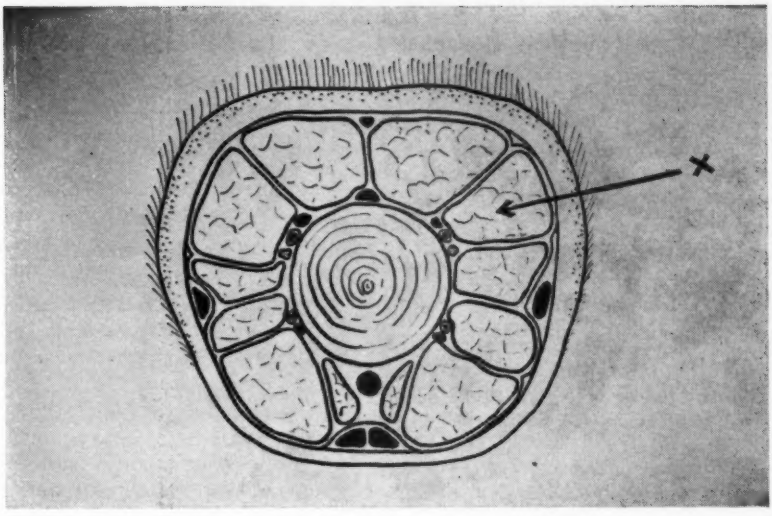
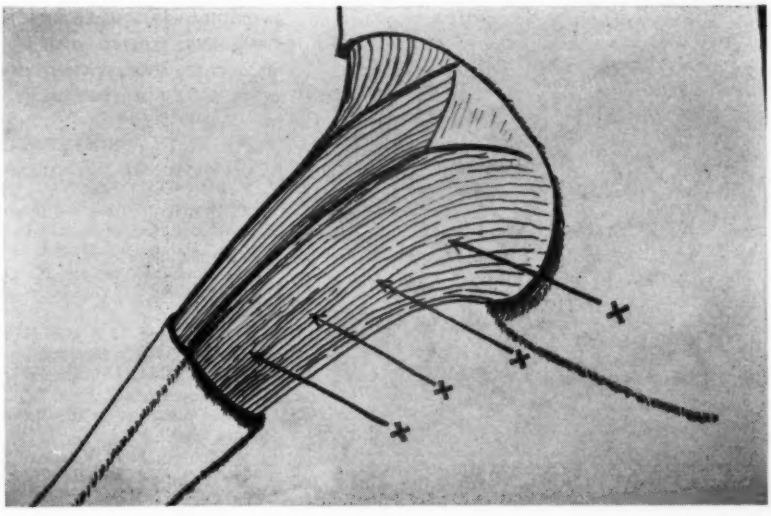


Figure 9.

illustrate sites of injection. Aftercare consists of tying the tail to the opposite side for a period of 3 weeks. It may be necessary for a second series of injections to be made in order to stiffen the muscles sufficiently.

Cases for this therapy must be selected carefully. This procedure will not work on a limber tail, nor will it work where there is excessive scar tissue and fibrotic tissues from excessive tail surgery. This procedure has been used on 9 selected cases. Results

Figure 10.



were satisfactory in 7. Two were improved but were not completely straightened.

Rectal Prolapse

Clinical trials of Dondren were conducted in 12 cases of rectal prolapse in the bovine. All cases were of a chronic nature and had prolapsed at least twice. Cases were selected in which the prolapse was fairly recent and the mucosa and submucosal tissues free from excessive necrosis and laceration.

Technic: An epidural anesthetic was administered prior to the injection of Dondren. If chronic tenesmus was a symptom, an in-place vinyl catheter was passed into the epidural space and retained for convenience of subsequent epidural anesthesia to control straining. The materials required for the procedure are a sterile 20 cc. syringe, glass or ranch record, and an 18 or 20 gauge, 2 or 2½ inch hypodermic needle. The rectal prolapse is manually reduced and a finger inserted into the rectum to locate and guide the position of the needle. Two to 3 cc. of Dondren are injected in a circular pattern into the sphincter and perianal tissue. Eight to 10 different sites are selected for the injections of Dondren. A total of about 20 cc. of Dondren has been found to be sufficient. Figure 11 illustrates the approximate injection sites of the drug.

Figure 11.

Immediately following the injection of the drug, a purse string suture is placed around the anus and left in place for 3 to 5 days. A satisfactory cicatrix forms in 7 to 10 days. If the prolapse reoccurs, a second treatment may be given.

Results: Of the 12 cases treated, 7 were positively corrected, 3 recurred and were corrected with a 2nd injection of Dondren, and 2 cases prolapsed a 3rd time and had to be surgically amputated.

Additional Uses

Sclerotherapy with Dondren has been used by the clinical staff in the treatment of umbilical hernias in 20 lb. to 50 lb. young pigs. The technic is very similar to that described for the equine. Three to five ¼ to ½ cc. deposits of Dondren are injected into the hernial ring. Too few cases have been accumulated to properly evaluate this treatment.

Dondren has also been utilized in treatment of deviation of the bovine penis. Approximately ½ cc. deposits are injected into the tunica albuginea and corpus cavernosa of the penis. The sites of injection are on the convex side of the deviation and the number of injections is determined by the extent of deviation. They are made approximately ¾ of an inch apart. Three cases have been treated with apparent correction in 1 case, improvement in another and no apparent improvement in a 3rd.

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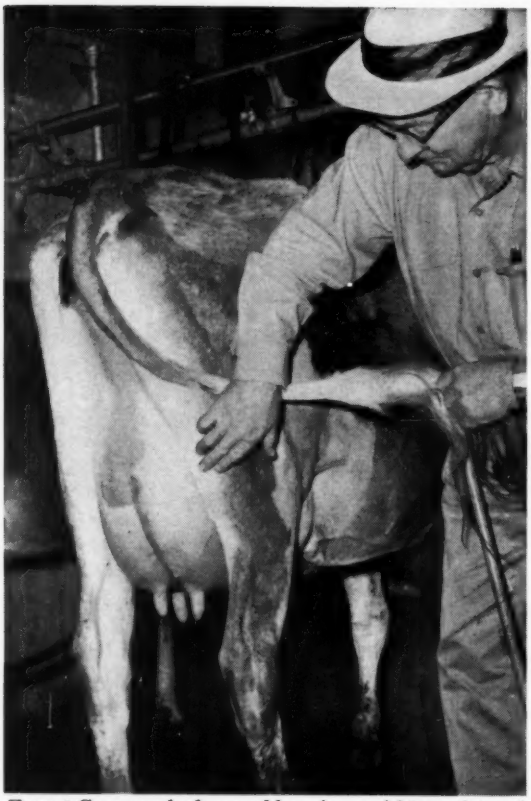

Ernest Greenough shows udder of one of his registered Jerseys vaccinated with CYANAMID STAPHYLOCOCCUS AUREUS TOXOID.

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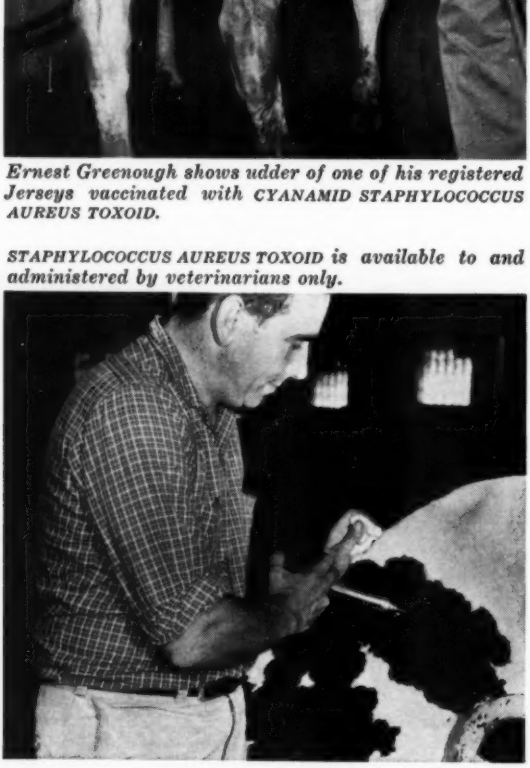

STAPHYLOCOCCAL MASTITIS

The problem of staphylococcal mastitis is increasing . . . many veterinarians state that from 40 to 60 per cent of the cases they are called upon to treat can be attributed to the persistent staphylococcic organism.

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Ernest E. Greenough, Merced, California, has devoted fifty years to the development of his outstanding purebred Jersey herd, and, among many honors, received the American Jersey Cattle Club's Distinguished Service Award for 1960. He says:

"I've been in the dairy business for the past 50 years. For most of that time mastitis has been a real problem, as it is for every dairyman. Our veterinarian started the use of Cyanamid Staphylococcus Aureus Toxoid in June, 1960. Right away, we noticed a dramatic reduction in the incidence of staph mastitis in our registered Jersey herd. I would recommend its use to dairymen everywhere who have a staph mastitis problem."

Mr. Greenough's veterinarian reports, "During the 11 years that I've been treating dairy animals in this area, I've used several autogenous bacterins, stock bacterins and toxoids with only fair results; but Cyanamid Staphylococcus Aureus Toxoid, Slanetz Strain, gives at least 25 per cent better results with fewer injections necessary. I've been using this vaccine since last June. The vaccine is in use in about 20 dairies in this area now. It is the most effective vaccine I've used yet for staphylococcic mastitis."

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Infectious Pustular Vulvovaginitis In a Pennsylvania Dairy Herd

D. C. Kradel, B.S., D.V.M.; R. F. Solorzano, B.S., M.S.; H. W. Dunne, D.V.M., Ph.D.; R. L. Michel, B.S., D.V.M.

A disease characterized by coughing, vulvovaginitis, fever, partial anorexia and a severe drop in milk production was observed in a Pennsylvania dairy herd. Conjunctivitis was observed in several of the young animals. The virus of infectious pustular vulvovaginitis was isolated from these animals. To the best of the authors' knowledge, this is the first reported and confirmed isolation of this virus from a Pennsylvania dairy herd.

History and Symptoms

The herd involved in this disease outbreak, occurring in March of 1960, was comprised of 40 head of Holstein milking cows and 24 head of young stock. All were stanchioned, with a water cup between each 2 animals. The ration consisted of grain, good quality mixed hay and corn silage. All animals were bred by artificial insemination.

The first symptoms observed were excessive coughing, lowered milk production and partial anorexia in some of the animals. Subsequent examinations during the next week revealed an abnormally frequent, pronounced, deep cough throughout the herd. Partial anorexia continued. Milk production dropped about 30% on a herd basis. The owner believed 70% of the cows showed signs of illness. Approximately 25% of the cows showed severely swollen, edematous vulvas. The vulvar mucosa was very red, contained whitish granular nodules and was streaked with a tenacious yellowish-gray exudate. Small desquamated areas were present on some of the vulvas. Manipulation of the vulva was painful and caused erosion of the epithelial layer and bleeding. Arching and switching of the tails, treading with the hind feet and difficulty in urinating were noted in some of the animals. Temperatures were elevated to between 104 to 107 F. A marked conjunctivitis char-

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The technical assistance of Mrs. Edmond Seguin was greatly appreciated.

acterized by intense congestion and swelling of the conjunctiva was observed in both eyes of a yearling bull and in one eye of a yearling heifer. A copious, whitish, purulent discharge was present and soaked the hair beneath the eyes. No corneal involvement was apparent. Both of these yearlings were partially anorexic and had a temperature of 106 F. No vulvar lesions were present in the heifer. These animals stood next to each other and shared a common water cup. None of the animals involved showed nasal or mouth lesions. Complete blood counts were essentially normal.

Treatment of some of the animals with Terramycin, penicillin, streptomycin, neomycin and sulfathiazole tablets was ineffective in altering the course of the disease.

Temperature elevations persisted for 3 to 10 days, noticeable vulvar swellings for 7 to 14 days and conjunctivitis for approximately 3 weeks. The vulvas of several cows examined 3 months after the outbreak still showed a definite redness and a well developed granular eruption but no discharge.

TABLE 1

Data of IBR Virus Isolation and Serum Neutralization Against 100 TCD_{50} of Stock IBR-IPV Virus

Specimen	Vaginal Tampon	Conjunctival Swab	Fecal Swab	Acute Sera	Convalescent Sera
1	*Virus Isolated	No Sample	Neg.	Neg.	1:10
2	Virus Isolated	No Sample	Virus Isolated	Neg.	1:16
3	Virus Isolated	No Sample	Neg.	Neg.	1:6
4	No Sample	Neg.	Neg.	No Sample	No Sample
5	No Sample	Virus Isolated	Neg.	Neg.	1:10
6	Virus Isolated	No Sample	Virus Isolated	No Sample	No Sample
7	Neg.	No Sample	Virus Isolated	1:4	1:4
8	No Sample	No Sample	No Sample	1:32	1:32

*Represents the ability of 100-1000 TCD_{50} of virus to be neutralized by 1:8 dilution of stock IBR-IPV antiserum (Titer 1:128 vs. 10 TCD_{50} of stock virus). Specimen No. 4—Yearling bull, specimen No. 5—Yearling heifer.

The stock antiserum and virus strain were obtained from Dr. T. S. Lien Chow, University of Colorado.

It took 3 months for the herd to return to normal production. Breeding efficiency did not appear to be affected. No abortions were attributed to the infection. One heifer aborted during the following year, but it would be impossible to attribute the abortion to the previous herd infection.

Virus isolations, using adult bovine kidney cells, were made from the vulvovaginal secretions and feces of affected cows and the conjunctiva of one heifer. Acute and convalescent blood was taken for serum neutralization tests. The results are summarized in Table 1. A greater than 4-fold rise in serum neutralization antibody titers in animals 1, 2, 3 and 5 further verified the presence of an active infection with IBR-IPV (infectious bovine rhinotracheitis-infectious pustular vulvovaginitis) virus.

Discussion

The virus of IPV (infectious pustular vulvovaginitis), shown to be identical to IBR (infectious bovine rhinotracheitis),[1] has been recognized as being capable of producing at least 3 distinct clinical entities (the rhinotracheitis common in western feedlot cattle[2] and reported in dairy cattle,[3,4] conjunctivitis with little other associated symptomatology in beef cattle,[5] and vulvovaginitis of dairy cattle.[6] The virus also will produce penile and preputial lesions in the bull similar to those appearing in the vulva of the cow. It has been isolated from range cattle,[7] from clinical cases of nasal catarrh or a "summer catarrh" in New Zealand dairy cattle,[8] and has been used experimentally to produce upper respiratory and digestive tract lesions in calves[9] and mastitis in cows.[10]

The infection in this Pennsylvania dairy herd produced apparent respiratory involvement, an acute vulvovaginitis and a conjunctivitis — all manifested clinically within one herd. This virus has produced such diverse syndromes as an acute upper respiratory infection with and without concurrent conjunctivitis,[2,11,12] acute vulvovaginitis with no apparent respiratory tract involvement,[6] an afebrile, congestive, serous conjunctivitis that later became purulent

but with no corneal involvement or other marked symptoms,[5] and then as recorded in this paper, all 3 syndromes within one herd. The apparent ability of this virus to involve explosively the majority of animals in the herd in one outbreak and again to occur as a sporadic condition involving only 1 or 2 animals in a herd[11] is indicative of its unpredictable nature. Recently, this virus was isolated in the Pennsylvania State University Veterinary Laboratory from the nasal material of a dairy animal showing a prolonged, chronic, respiratory condition in which she was the only such animal affected in a herd of 30 cows.[12]

In many cases the source of infection or mode of transmission cannot be determined. Venereal spread may be common where natural breeding is used[9,14] but in many outbreaks, as in the one reported in this paper, artificial insemination was used and venereal transmission could not have occurred. Methods of spreading, other than venereal transmission, that have been suggested or incriminated are licking of the external genitalia by dogs,[14] contact with infected straw or urine (as could occur particularly with automatic barn cleaners) and transmission of the virus during tuberculosis testing. The isolation of the virus from the fecal material in this outbreak would suggest fecal contamination as a source of infection. There appears to be some unknown triggering mechanism that produces suitable conditions for the disease to suddenly manifest itself. The presence of subclinical carriers has been suggested.[11] It is interesting to note in Table 1 that cow No. 8 had been purchased from Wisconsin a year previously. She had freshened and developed a rhinitis, bilateral conjunctivitis and high fever after arrival at the farm. Vulvar lesions may have gone unnoticed because of the normal vulvar swelling that is often present at freshening. During the outbreak reported in this paper, she remained normal but both her acute and convalescent sera showed a highly significant 1:32 titer, which indicates an immune state. Unfortunately, samples were not taken from this animal for possible virus isolation.

Fertility and pregnancies did not appear to be affected in this infection. Most clinical evidence supports this observation, although abortions in pregnant heifers have been reported.[3]

Antibiotic and sulfonamide therapy did not appear to alter the course in those treated. Clinical evidence from other field cases would substantiate the contention that systemic and local treatment is ineffective, Local treatment also appears difficult to administer due to the extreme tenderness of the vulva.[14] Commercial vaccines are available and effectively used in feedlot cattle. These vaccines have not caused any drop in production or other signs of illness when given to dairy cows.[15] The efficacy of vaccinating dairy cattle would depend on incidence, presence of the disease in the area and possible economic factors.

Summary

An infectious disease that was characterized by fever, coughing and severe vulvovaginitis in adult cows and conjunctivitis and fever in 2 yearlings occurred in a Pennsylvania dairy herd. The virus of infectious pustular vulvovaginitis (same virus as IBR, infectious bovine rhinotrachetitis) was isolated from the vulvovaginal secretions and feces of these animals. It was also isolated from the conjunctiva of a heifer with severe conjunctivitis. Significant rises in antibody titers from the sera of these animals as measured against stock IBR virus, verified the diagnosis of an active infection.

The diverse syndromes which can be produced by the IBR virus include an upper respiratory syndrome, conjunctivitis, vulvovaginitis, balanitis and experimental mastitis. Possible sources of infection and means of transmission are briefly discussed, with the suggestion that a cow imported into this herd a year previously could have been a subclinical carrier. Treatment was ineffective in altering the course of the disease. Vaccination is also briefly discussed.

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Management of Tetanus

The aims of tetanus management are early diagnosis, early therapy and supporting care. The therapy is essentially symptomatic.

The rate of regression of symptoms is about the same in both mild and severe forms of tetanus. This period ranges from 11 to 47 days with an average of 24 days. A fixed time is necessary for removal of the tetanus toxin and "uncoupling" is related more to time than quantity.

Antitoxin is given to neutralize circulating toxin and prevent more toxin absorption into the central nervous system. Adequate blood levels can be obtained with injections of 80,000 to 100,000 units of antitoxin. Toxoid and antitoxin should not be administered simultaneously.

Good surgical principles should be applied to care of the wound. All necrotic tissue and tissue with an adequate blood supply should be removed. Good hemostasis should be obtained to prevent hematoma formation. Débride grossly infected wounds widely. Whenever possible, culture the wound.

Tracheostomy has been advocated in the management of tetanus. With present-day relaxants, however, this is not necessary. It should be done when the incubation period and onset time are short, when respiratory spasms are longer than 15 seconds and when there are laryngeal and pharyngeal obstructions due to spasms and secretions.

For sedation, meprobamate appears to be the drug of choice. It abolishes reflex spasms due to noise and light. Single injections of 400 mg. are given to adults every 3 or 4 hours. The dosage must be adjusted to each case. When additional control is needed, chlorpromazine, promethazine and pentobarbital can be added as needed.

An intravenous infusion should be maintained until the effects of therapy are evaluated. Daily I.M. injections of penicillin should be given. A cleansing enema should be given early, but urinary catheters should not be used unless absolutely necessary. Feed via stomach tubes, because swallowing is impaired. Select the diet carefully and supplement it with additional vitamins.

Check hemoglobin level 3 times weekly, as anemia may develop. During convalescence, check thoracic vertebra for compression fractures with a radiograph.

Arthur J. Oswald, Post. Med., 29:608, 1961.

Equine Practice

Observations and notes on equine practice gleaned from 40 years of veterinary experience by A. H. Quin, D.V.M.

The Sleeper Foal Syndrome

The versatile microorganism named *Bacterium viscosum equi* or *Shigella equirilus* is one of the most common killers of newborn foals, the so-called sleepers.

Born at full term, the foal fails to nurse and fades away rapidly, with death usually on the 3rd day. The infection is intrauterine in origin and, unless complicated by other infection, the umbilicus and cord may appear quite normal.

Dimock makes 3 classifications of these cases: (1) Those dead at birth or showing characteristic symptoms at birth but in a semicomatose condition. (2) Those showing symptoms of sickness at birth but more or less active. (3) Those apparently normal at birth but developing the disease 6 weeks to 5 months later.

Generalized septicemia without joint or tendon sheath involvement may occur. But, in most cases, joint involvement appears if the foal lives more than 24 hours and the joint exudate is a mucopurulent material. In the subacute cases profound involvement of the kidneys is common.

Even in the early detected cases the prognosis is always guarded. For treatment, full doses of streptomycin appear to be the antibiotic of choice. This is backed by subcutaneously stripping 100 cc. to 200 cc. of defibrinated mare's blood, hand feeding and intravenous electrolytes with dextrose. Coramine or other stimulants are injected as indicated.

Quick Test for Poisoning

There is always the possible risk of either malicious or accidental poisoning of valuable horses by arsenic or other heavy metals. A case in point occurred a few years ago when a discharged groom returned later and poisoned several fine standard-bred mares with arsenic.

A practical presumptive test is as follows: Place a ball of feces in a fruit jar. Add 90 cc. of water containing 10 cc. of concentrated hydrochloric acid. Add a penny or a 2-inch length of copper wire. Mix with a glass rod and boil gently under a cover for 25 to 30 minutes. Then remove, wash and dry the penny or piece of copper wire. A blackish discoloration or deposit is tentative evidence of arsenic, antimony or mercury.

Guttural Pouch Tympany

A long-stabled mare turned to pasture with her foal develops a tense bilateral swelling of the parotid region with extension of the swelling between the rami of the mandibles. When one side of the drum-tight swelling is pushed, it bulges on the opposite side but

there is little or no pain and the body temperature is normal. This accumulation of air in the guttural pouches is a benign and transient condition. Return the mare to the stable and tie short with a loose-fitting halter, then apply some white liniment by firmly massaging with the palm of the hand. This is the only treatment needed.

Sand Impaction

Sand impaction with resultant severe colic is not too rare an equine malady in some parts of the country, especially in a season of short grass.

One reasonably successful treatment is a pound of magnesium sulfate or 2 pints milk of magnesia in 5 gallons of reasonably warm water via the stomach tube, followed in 1 hour by ¼ to ½ grain of arecoline hydrobromide subcutaneously. Repeat at 6 to 8 hour intervals until sand begins to appear and follow with a high enema.

Practice Tips

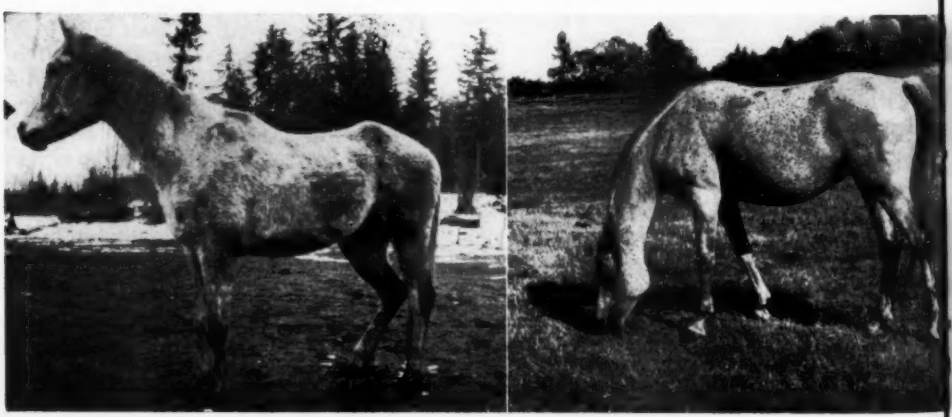
The standard, soft-elastic 5 cc. tetrachlorethylene capsules used for worming adult sheep and goats are convenient and efficient for the treatment of blood worms (strongyles, etc.) in Shetland ponies. Give pony colts from 100 lb. to 200 lb., 1 capsule; 20 0lb. to 300 lb., 2 capsules; 300 lb. to 450 lb., 3 capsules. Lubricate them well and follow with a drench of saturated Epsom salts solution.

Even though an owner may be insistent, it is good policy to avoid giving carbon disulfide to a mare within 40 days of foaling.

An old stand-by that is hard to beat for strains, mild arthritis, synovitis, slow ripening abscesses, etc., is a saturated solution of resublimed iodine crystals in glycerine. Dispense it in 4 to 8 ounce prescription bottles with an "M. Sig." to rub into the affected area with gloved finger tips twice daily to effect.

For acute founder, an initial dose of 100 units of ACTH and an additional 50 units in 24 hours is indicated. ACTH influences retention of sodium chloride and excretion of potassium, thus having a direct influence on osmotic pressure in both blood and tissues.

Stallions are more susceptible to the purgative action of aloes or aloin than are mares and geldings. The penalty for an excessive dose is a serious case of superpurgation. The dose of aloin with adjuvants for stallions should not exceed 180 grains (3 drams).



Arab type mare with a heavy infection of strongyles and sclerostomes. Note debilitation, weight loss and anemia (left) and striking recovery (right) after appropriate anthelmintic treatment. Photo—Dr. Ray Bradbury, Mt. Vernon, Wash.

Infectious Diseases

Rabies in the Domestic Cat

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There is little information available on the occurrence of rabies in the domestic cat. While it is widely recognized that the cat is susceptible to the disease and serves as a transmitting host, there is little consideration given in the literature to its epidemiological or clinical aspects. The importance of rabies in cats is demonstrated by the fact that next to the dog and fox the cat is the animal most frequently reported to be rabid.[1] While cats and kittens are more resistant than dogs and puppies to challenge with street virus by the peripheral route, it appears that the great majority of cats that develop rabies exhibit the furious form of the disease. They are, therefore, a threat to man and other animals.[2] During the period from 1938 through 1958, there were 7,963 cases of reported feline rabies in the United States.[3] There have been 324 laboratory confirmed cases of rabies in cats during the last 10 years in Missouri, as compared to 1,368 cases in dogs during that same period.[4] It should be pointed out that there has been a significant decrease in the number of rabid dogs, while the incidence in the feline remains about the same.

During the period from 1946 through 1960 there were 5 human deaths due to rabies contracted from cats out of a total of 138 human cases reported in the United State.[5] One additional human rabies death was attributed to transmission by a cat, but the exposure occurred outside of the United States.

The following cases are presented to show the variation of clinical symptoms which may be displayed by rabid cats.

Case No. 1. A 4-month-old female kitten was observed fighting with a family dog. Two days later it bit a boy on the hand and scratched his sister. The children's parents were exposed to the saliva of the cat. The cat was then presented to the University of Missouri Veterinary

Clinic for examination. It appeared friendly but made no attempt to eat or drink. Its reflex actions were exaggerated. A tentative diagnosis of rabies was made.

Purring occurred until about 24 hours before death. On the 3rd day following onset of symptoms a purulent exudate was noticed in the left conjunctival sac. By the 4th day both eyes were involved and were completely closed. The animal became dehydrated and posterior weakness was observed. On the evening of the 5th day a slight clonic tetany was noted. Throughout the morning of the 6th day the animal exhibited prominent clonic tetany and by that afternoon it was believed the cat was near death, so it was euthanized and a necropsy performed. Impression smears of the hippocampus stained with Seller's stain revealed Negri bodies. Mice inoculated intracranially with brain tissue from the cat died 13 days later. Impression smears prepared from brain tissue of the mice also revealed Negri bodies.

Case No. 2. This case is more unusual in that the cat involved lived 11 days after symptoms were first noted. One of a litter of 3-month-old farm kittens, developed a sudden change in disposition. Two children playing with the cats had not noted any signs of aggressiveness. Vicious behavior was first noticed when the cat fought with its littermates. The following day it bit a boy when he picked it up. The next morning, the cat suddenly attacked a girl, biting and scratching her legs severely. The animal was admitted to the University of Missouri Veterinary Clinic on the 3rd day after symptoms were noted. At that time the cat was vicious and would attack anything which moved. The pupils of both eyes were equally dilated. Water was taken freely and food was nibbled, but little was actually consumed. A tentative diagnosis of rabies was made.

Unequal dilatation of the pupils was noted on the 4th day following onset of symptoms. The unequal dilatation continued until the cat's death. At this time, it was noticed that the cat would extend its tongue into water but could not cup it to drink. Food was taken into the mouth, but swallowing movements could not be detected. From this time until death, the animal alternated between vicious attacks toward any moving objects and a crouching position in a dark corner of the cage.

On the 5th day a slight posterior weakness was noted. This became more pronounced until on the 11th day the cat could only partially raise its forequarters. It tried to take some water on the 6th day but after that, it made no more attempts to eat or drink. The animal was not observed to make any vocal sounds during the entire observation period. A progressive dehydration was evident throughout the course of the disease.

On the 11th day the cat was extremely dehydrated and appeared near death. It was euthanized and impression smears of the hippocampus revealed a few atypical Negri bodies. Brain material was injected intracranially into mice, which died 15 days later. Impression smears of the mouse brains revealed few typical Negri bodies. It was not until the 3rd mouse passage of the virus that larger numbers of Negri bodies were observed.

It has been pointed out by Price[4] that rabies is frequently transmitted to cats from skunks, since these animals apparently are compatible with each other. The incubation period in the cat is 20 to 60 days, being either longer or shorter in a few cases.[1] Symptoms of rabies in cats, as shown in the above cases, vary widely, and this should be taken into consideration when observing cats for evidence of the disease. Since nonspecific intracytoplasmic inclusion bodies are occasionally seen in the brains of cats, the head of any cat suspected of having died with rabies should be submitted to a qualified laboratory for cytological examination and mouse inoculation tests.

Regulations concerning the interstate movements of cats are practically nonexistent. Michigan requires that cats be accompanied by a certificate of health issued by a legally qualified veterinarian. Hawaii imposes a 120-day quarantine on all cats and Puerto Rico requires a health certificate and vaccination of all cats more than 8

week of age. All other states allow unrestricted movement of cats across their state lines.[6]

Cats may be effectively immunized against rabies with either HEP (Flury) strain vaccine or the nerve tissue vaccine.[7,8] LEP (Flury) strain vaccine should not be used in cats, for occasionally a kitten less than 4 months of age will succumb to this vaccine. The dosage of vaccine for cats is about ½ the dose for an average-sized dog. There are no data on the duration of immunity conferred by rabies vaccination in cats. The United States Public Health Service urges and encourages cat owners to have their animals immunized. However, cats are not included in mass immunization campaigns, since experience has shown that when the disease in dogs and wildlife has been eliminated by intensified measures, the disease will no longer persist in the cat populations.[4,5]

The Expert Committee on Rabies of the World Health Organization[7,8] urges that unvaccinated cats bitten by a known rabid animal be immediately destroyed. Should the owner be unwilling to destroy the exposed animal, strict isolation of the animal in a kennel for 6 months should be enforced. If the animal has been previously vaccinated within 3 years with Flury strain vaccine (or within 1 year with other vaccines), revaccination and restraint (leashing and confinement) for 30 days should be carried out.[6]

Summary

Rabies in the domestic cat continues to be a source of danger to humans and exposed animals. There has been a significant decrease in the occurrence of canine rabies in the past few years, but the number of cases of feline rabies remains relatively constant. Thus, the cat is becoming a more important factor in the rabies control problem.

Two case reports are presented to describe the wide variation in symptoms which may be seen in cats being observed for rabies. In the 2 cases reported there were 6 humans exposed, all of whom received the Pasteur treatment. Both cases were confirmed by Negri body examination and mouse inoculation.

Cats may be effectivly immunized against rabies with either HEP (Flury) strain vaccine or nerve tissue vaccine by using ½ the dosage for an average-sized dog. It is recommended that cats exposed to rabid animals be euthanized whenever possible.

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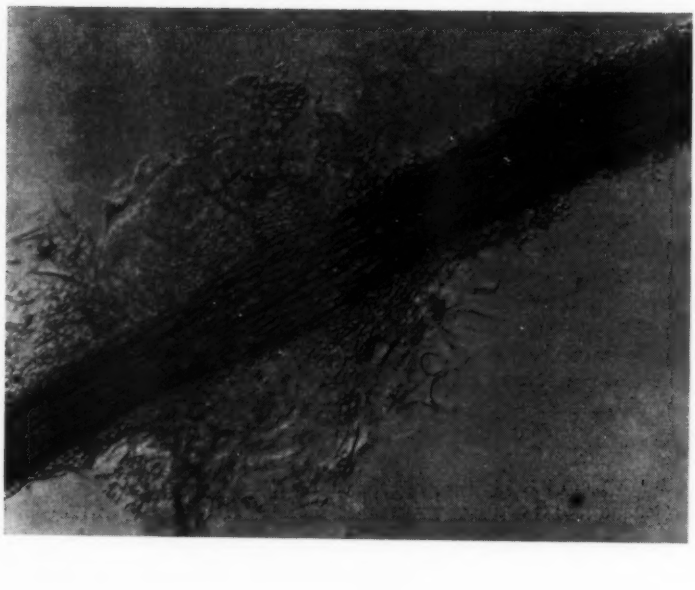
Prevalence of Toxoplasmosis in Dogs

Campbell, of the University of Glasgow Veterinary School, reports in the British Small Animal Veterinary Association's *Congress Proceedings* that toxoplasmosis due to the protozoon, *Toxoplasma gondii*, has been observed in 6.6% of dogs that were carefully autopsied, primarily because of distemper. In other words, this leads to the impression that the disease in dogs is an occasional complication of distemper. It has also been observed in man and mink, in conjunction with tuberculosis, whooping cough and malaria. To the naked eye the protozoon is practically a lesionless disease. When it affects the lungs, liver or heart, it is usually visible because of necrotizing action and looks like miliary tuberculosis.

R. R. Dykstra



A Medicated Aerosol for Treatment Of Microsporum canis

E. J. Foley
Schering Corporation

The effectiveness of griseofulvin administered orally for the treatment of dermatomycosis in man and animals is well established. Following absorption from the gastrointestinal tract, an effective concentration of griseofulvin is distributed in keratin precursor cells. The unchanged griseofulvin which remains within the cells when they differentiate to keratin renders the resultant structures resistant to fungus growth. Thus, although the griseofulvin deposited in the hair and skin during treatment prevents in-

vasion by fungi, the distal portions of the hair remain infected. Shedding of these infected hairs constitutes a source of infection to other animals, to human subjects and to bedding or kennel areas. The following experiments were undertaken in an attempt to develop a procedure for adjunctive therapy which would prevent cross infection from animals under treatment by oral medication.

Experimental Study

Three aerosols were prepared for *in vitro* and *in vivo* experiments. Preparation A contained undecylenic acid, B contained griseofulvin, and C (Fulvidex, Schering Corp.) a combination of both agents. A single 3-second burst of each of these aerosols deposited on the infected surfaces 3.2 mg. of undecylenic acid, 1.6 mg. of griseofulvin, or 3.2 mg. of undecylenic acid together with 1.6 mg. of griseofulvin. The cultures employed were *Microsporum canis*, most of which had been recently isolated from spontaneous cases of ringworm of dogs. They were maintained in Sabouraud's agar. All failed to grow in Sabouraud's agar containing 1 to 0.5 micrograms/ml. of griseofulvin.

Swatches of normal hair clipped from areas on the flanks of dogs which had been sprayed with the griseofulvin-undecylenic acid mixture were placed on the surface of Sabouraud's agar which had been cross-streaked with cultures of *Trichophyton mentagrophytes, Trichophyton rubrum* and *M. canis*. Upon incubation, these cultures revealed zones of inhibition of growth extending from the edge of the treated hair bundles. This effect is obviously the result of diffusion of the active ingredients from the hairs into the culture medium. Untreated hair showed no fungistatic effect.

Hairs from infected dogs were placed in petri dishes and sprayed with Preparations A, B and C. The dishes were covered and left at room temperature. Hairs were removed daily with forceps rinsed in 10 ml. of distilled water and placed on the surface of Mycosel agar (Baltimore Biological Lab.) to determine viability of the fungi. Examination under a Wood's light for characteristic fluorescence was also conducted daily.

The results in Table 1 show that the aerosols containing undecylenic acid alone or griseofulvin alone were ineffective in killing the fungi associated with the infected hairs. The aerosol containing both compounds was fungicidal. However, the fungi remained viable up to 4 days following application of Fulvidex Aerosol. It is apparent that loss of viability precedes the disappearance of fluorescence. Hairs treated with a single burst of Fulvidex Aerosol remained fluorescent, although cultures were consistently negative after the 4th day follow-

TABLE 1
Effect of Impregnation of Infected Hair with Aerosols on Viability of Fungi and Fluorescence of Infected Hair

Aerosol Treatment	Days after Treatment that Fungi of Infected Hairs were Viable (V) and Hairs Fluorescent (F)									
	1	2	3	4	5	6	7	8	9	10
Undecylenic Acid 3 bursts	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF
Griseofulvin 3 bursts	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF
Fulvidex 1 burst	VF	VF	VF	F	F	F	F	F	F	F
Fulvidex 2 bursts	VF	VF	VF	F	F					
Fulvidex 3 bursts	VF	VF	VF	F						
Untreated	VF	VF	VF	VF	VF	VF	VF	VF	VF	VF

ing treatment. Those treated with 2 or 3 bursts were not viable when cultured on the 4th day and were not fluorescent on the 6th day after treatment. Untreated controls remained viable and fluorescent for the duration of the experiment.

TABLE 2

Response of *M. canis* Infections to Topical Treatment with Aerosols Containing Undecylenic Acid, Griseofulvin and Mixtures of Both Ingredients

Aerosol Treatment	Days Following Treatment that Fungi in Infected Hairs were not Viable		
	Dog 9	Dog 10	Dog 11
Fulvidex	8	10	12
Undecylenic Acid	18	24	X
Griseofulvin	22	X	X
Propellant Only	X	X	X
No Treatment	X	X	X

X—Still viable at 28 days.

Three young beagles were infected in 5 discrete areas of the skin over the back by the following technic: An area approximately 5 cm. in diameter was abraded with fine sandpaper, care being taken to cause only a slight erythema. A spore suspension obtained by washing the surface of a 10-day-old Sabouraud's agar culture of *M. canis* was vigorously rubbed into the abraded area. The hair was not clipped. All areas developed characteristic lesions, which yielded positive cultures and developed fluorescent hairs within 1 week. Treatments were begun 10 days after the infection was induced. This consisted of applying 2 bursts of the various aerosols to the appropriate lesions in the morning and again in the late afternoon. The aerosols employed consisted of propellant alone, propellant with either undecylenic acid or griseofulvin, or the mixture of undecylenic acid and griseofulvin. One lesion was reserved as an untreated control. Treatments were given daily for 4 weeks. Hairs were plucked from the lesions and cultured in Mycosel agar. Examinations were made for fluorescence with a Wood's light on alternate days. Results of this experiment are shown in Table 2.

It is shown in Table 2 that the aerosol containing both griseofulvin and undecylenic acid was promptly effective in healing the lesion and rendering the fungi of the infected hair nonviable. In all 3 dogs, loss of fluorescence was observed within 4 days following the time that cultures became negative. All other infected areas remained fluorescent over the entire 28-day period of observation, although negative cultures were eventually obtained from lesions treated with the undecylenic acid and the griseofulvin aerosols.

Further trials of the curative effect of

TABLE 3

Response of *M. canis* Infections on Dogs to Topical Treatment with Fulvidex

Dog No.	*M. canis* Strains Used to Infect	Days of Infection Before Treatment	Days Following Treatment that Cultures of Infected Hairs were Negative				
			Treated Lesion	No. of lesions	Untreated Lesion		No. of lesions
1	LE	10	8	(1)	pos. at	28	(1)
2	BL	10	6	(1)	"	28	(1)
3	LE	14	8	(2)	"	28	(1)
	LNT-73	14	6	(1)	"	28	(1)
4	BL	14	6	(3)	"	28	(1)
5	LE	10	12	(1)	"	28	(1)
6	VM-247	10	16	(1)	"	28	(1)
7	LMT-77	10	16	(1)	"	28	(1)
8	LMT-93	10	16	(1)	"	28	(1)

the griseofulvin-undecylenic acid mixture aerosol were made in additional dogs infected with other cultures of *M. canis*. Infections were induced as previously described on 2 or more areas of the backs of young beagles. One lesion on each dog was left untreated. Two bursts of the aerosol were applied morning and afternoon for a period of 3 weeks. The results in Table 3 show that all of the treated areas were cured, as indicated by repeated negative cultures of infected hairs. There appeared to be a difference in response to treatment depending upon the cultures used to infect. Thus, it required 16 days of treatment to cure lesions induced by cultures VM-247, LMT-77 and LMT-93, whereas negative cultures were obtained from lesions induced by cultures LE, BL and LMT-73 in from 6 to 12 days. Loss of fluorescence of infected hairs followed within a few days of the time negative cultures were first obtained. At the end of the 28-day observation period, all untreated control areas were clipped and the dogs were treated by daily oral administration of 250 mg. of griseofulvin for a 2-week period. All areas on all dogs in experiments shown in Tables 2 and 3 were nonfluorescent and failed to yield viable *M. canis* on culture after this course of treatment.

These data show that the mixture of griseofulvin and undecylenic acid exerts fungicidal action against *M. canis* associated with infected hairs. Presumably the fungus-killing effect is due to coating the infected hairs with a mantle which interferes with the vital physiology of the fungi. It appears that the fungicidal process proceeds slowly, since negative cultures were not obtained until the 4th day after application of the mixture as shown in Table 1. Loss of fluorescence of treated hairs persisted for various periods of time following loss of viability in culture. In all instances, it was observed that prompt healing of the lesion followed conversion of cultures from positive to negative, whereas lesions which yielded positive cultures exhibited persistent typical inflammatory signs. Both griseofulvin and undecylenic acid are highly active in preventing the growth of pathogenic fungi, and it is of interest that either compound used alone was less effective than the combination of both ingredients. It is known that the antifungal effect of unsaturated fatty acids depends upon pH and solubility.[1,2] Thus, the free acid is far more active than salts. Griseofulvin appears to be uniformly effective against *M. canis* isolated either from man, cats or dogs. In our experience, over 30 isolates form clinical material were inhibited in Sabouraud's agar containing 1 to 2 micrograms/ml. of this compound. Resistant strains of *M. canis* have not been encountered nor have they been reported in the literature.

It is obvious that these results have implications both for the treatment of dermatomycosis of animals and in preventing the transfer of infected hair to human or animal subjects. It remains to be determined whether concomitant treatment of infections characterized by fungal invasion of hair structures with griseofulvin-undecylenic acid aerosol and oral therapy with griseofulvin will shorten the course of therapy. In any event, such a regimen is indicated in order to kill fungi present in distal portions of hair which are not affected by griseofulvin administered orally.

Summary

Experiments are described in which *M. canis* fungi from infected hairs in spontaneous cases of ringworm of dogs were rendered nonviable when treated with an aerosol containing undecylenic acid and griseofulvin (Fulvidex). Experimentally induced *M. canis* infections of dogs were promptly cured by application of the medication. These results are discussed in relation to the problem of transmittal of infection to new hosts by hairs harboring pathogenic fungi.

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Therapeutic Management of Acetabular Dysfunction

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Editor's Note: These studies are not published with the implication that therapeutic management is a possible alternative to the elimination of hip dysplasia by breeding selection. The potential merit of therapy for children afflicted with this condition justifies complete and thorough investigation. The dog is a logical and useful experimental animal.

The primary purpose of this paper is to stimulate interest and further investigation of the therapeutic value of Arlidin (Nylidin hydrochloride, U. S. Vitamin and Pharm. Corp.). The author realizes that the number of cases covered by this report may be considered inadequate for a valid evaluation of the therapy and that the findings may therefore be open to question. However, the results obtained in this limited series of cases have been sufficiently encouraging to warrant further investigation.

Acknowledgment is due the Narbareth Animal Hospital and its staff for their aid in carrying out this study.

Certain investigators have come to the conclusion that congenital hip dysplasia is an inherited structural defect manifesting itself in the embryonal or fetal state.[1,2,3,4] This paper will not deal with the genetics of the disease but with its characteristics and treatment.

Congenital hip dysplasia results from a poor development of the upper acetabular margin and an inadequate socket attributable to delayed or defective ossification in the fetal stage. Following birth and during the period of 3 months to 1 year of age, the progressive increase in weight bearing tends to wear down the acetabular rim more rapidly than it is repaired. The continued increase in mechanical wear from walking often leads to subluxation, dislocation, coxa plana, coxa vara, coxa magna and to traumatic osteoarthritis. These defects may involve only one acetabulum or, as pointed out by Hart, all the skeletal structures of the hip.

The underlying cause of this condition is unknown; however, there is one possible explanation that has been overlooked—an inadequate blood supply to the affected part or parts. If there is an insufficient blood supply to the area of the acetabulum and femoral area during the early stages of development and growth, could not this be a causative factor responsible for delayed ossification and a shallow acetabulum? An adequate blood supply in the vascular bed surrounding these parts is essential for providing nutrients needed for the development, maintenance and repair of these structures. Carrying this reasoning a step further, as the fetus and later the growing animal mature, there is continuous mechanical wear of the involved skeletal structures. This mechanical wear exceeds the ability of a deficient blood supply to provide the nutrients essential for normal growth and maintenance. The degree of vascular deficiency and/or the ability to adapt determines the severity of the dysplasia, the various grades of the affliction and the instances where recovery has been spontaneous.

Several years ago Arlidin, a drug with distinct vasodilative properties, came to the author's attention. In contrast to other agents of this type which act on the superficial cutaneous vessels, Arlidin exerts its vasodilating effect on the deeper vessels of skeletal muscle. It also increases cardiac output and greater circulating blood volume without causing any significant change in pulse rate or blood pressure. Arlidin has also been reported to increase retinal blood flow by approximately 30%[5] and to be clinically effective in the treatment of loss of hearing associated with labyrinthine ischemia.[6]

If the theory on the inadequacy of blood supply as a causative factor of congenital hip dysplasia is valid, the administration of Arlidin should alleviate the symptoms and arrest the progress of the disease.

Clinical Study

To date, 13 dogs have been placed on the drug. All cases were diagnosed and confirmed radiographically. All cases exhibited posterior lameness and manifested signs of pain. The animals were of the larger breeds, Shepherds, Newfoundlands and Retrievers, but predominantly Shepherds.

The initial dose was 1 Arlidin tablet 2 or 3 times daily, depending on the severity of the condition. The animals have now been under treatment for periods ranging from 2 to 7 months. Pain and lameness in 10 cases completely subsided within 1 week after treatment was started; 2 cases showed only partial relief, and 1 case did not respond to treatment. In 2 cases the symptoms recurred when the drug was discontinued but again were relieved when treatment was restored.

Duration of symptoms did not seem to be a determining factor with respect to response to treatment but rather the severity in the involvement of the acetabulum. For example, 1 case had been under treatment for 3 months without improvement prior to having been brought under my care and yet responded to Arlidin therapy within 1 week. In another case that had a more severe involvement of the acetabulum only partial relief was obtained, even though the owner brought the animal in soon after symptoms were noted.

The severity of the condition is graded on the basis of *x*-ray examination. Symptoms alone are not a satisfactory index of the severity of the acetabular defect. It should also be added that owners are notoriously poor in noticing the peculiar gait manifested in the early stage of this disease.

In the average case, 1 Arlidin tablet was administered twice daily for 1 month, 1 tablet daily for the next 2 months and then discontinued entirely. In one instance there was a recurrence of symptoms when the daily dose was reduced from 2 to 1 tablet. The other case suffered a recurrence when therapy was discontinued entirely at the end of 3 months. Both animals responded when medication was resumed.

Diagnostic *x*-rays were taken in all cases in this study. Five cases were returned for follow-up *x*-rays; the owners of

the other animals that responded were contacted and reported that there had been no recurrence of symptoms. Particularly significant is the fact that in all follow-up *x*-rays the findings correlated with the clinical result.

In conclusion, it is felt that this treatment should be used only on animals that are not or will not be used for breeding. Selection and elimination of affected animals as suggested by McClave[7] is the only answer to a permanent resolution of this condition. If this drug does have the therapeutic merit indicated by our preliminary findings, a controlled and larger clinical study is needed to confirm these results.

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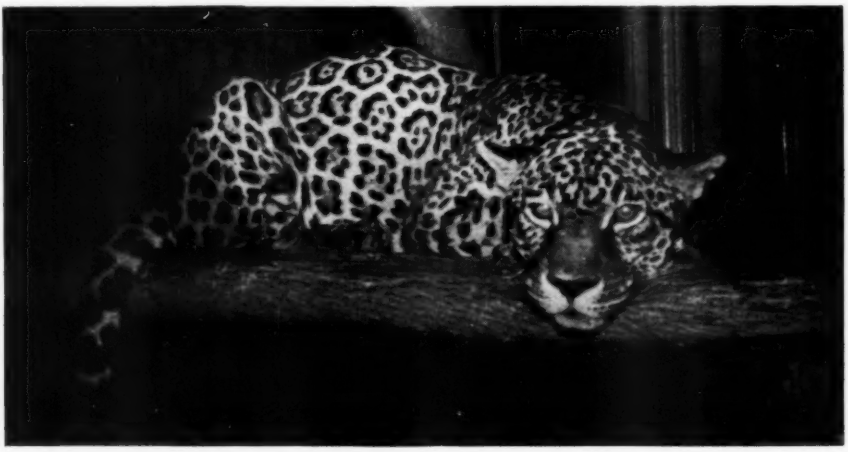

Immobilization of Captive Wild Animals

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Since the development of the projectile syringe gun and its use to immobilize wild deer,[1] many workers including zoo veterinarians, conservationists, game department officials and others have applied this equipment to the purpose of immobilizing a great variety of wild animal species both in captivity and in the wild state. Reports, both published and unpublished, from many of the workers indicated that in many instances nicotine alkaloids which were initially utilized to produce immobilization were causing severe and often fatal side effects.[2]

Succinylcholine chloride was selected as an immobilizing drug potentially preferable to the nicotine alkaloids, since it was considered that it would provide a muscle-relaxing or paralyzing effect without producing the numerous undesirable pharmacologic actions produced by nicotine com-

pounds. The pharmacologic action of succinylcholine chloride has been described in other publications[3,4] and will not be included in this paper.

It is the purpose of this paper to present experiences at the San Diego Zoological Gardens in the use of succinylcholine chloride delivered with the projectile syringe to immobilize several species of wild animals, either for the purpose of capture and transport to other locations, or to allow examination and various treatment procedures to be carried out on the animals.

A standard solution of succinylcholine chloride of 20 mg./cc. was used in each trial. Where total doses of less than 20 mg. were required, the solution was diluted with sterile water to bring the volume up to at least 1 cc. The drug was administered in each case by an automatic projectile syringe delivered by a gas (CO_2) powered rifle or pistol. All shots were made in the heavy muscle area of the upper thigh except in the sea lions, where intraperitoneal injections were made. Table 1 lists the trials including the species, dose employed, time required to produce effect and duration of effect, with comments on the actions and effects produced.

In each of the above successful cases, the onset of drug action was heralded by a trembling of the neck, forelegs and hindlegs; the animal would then attempt to walk, but would evidence marked ataxia of a few seconds' duration, then collapse to its knees, at the same time kicking with its hindlegs. Most of the animals would then roll on their sides, give a few struggling kicks with the forelegs and hindlegs, and then lie still.

In the case of the lion (Trials No. 8 and 9), where only partial immobilization and ataxia were produced, the same initial signs of drug action were observed. However, the animal remained in sternal recumbency with its head up and was able to extend the limbs sufficiently to raise its sternum off the ground. A similar reaction was observed in the bears, which apparently had not received sufficient medication (Trials No. 14, 16 and 32) to produce complete locomotor paralysis.

In Trials No. 6 and 7, respiratory arrest was doubtlessly due to an excessively large dose of medication. Oxygen resuscitator apparatus was not available at these trials, and manually attempted artificial respiration was inadequate to revive the animal. The simultaneous cessation of respiration and cardiac action in Trial No. 22 suggests that fright and shock may have been responsible for the death of this animal, which manifested great anxiety before the injection. A similar "psychogenic shock" reaction may have been the cause of death in Trial No. 43.

The deaths of the sea lions in Trials No. 11 and 36 were obviously due to overdose of drug. In the mule deer (Trial No. 4) artificial respiration provided by an oxygen resuscitator was sufficient to maintain the animal until the succinylcholine chloride became eliminated by hydrolysis.

The experience of total failure to obtain any drug action in Trials No. 24, 25, 37, 38 and 39, are suggestive that the drug was ineffective due to the fact it had been held without refrigeration for 2 to 3 hours before administration or because of premature discharge of the syringe before reaching the animal.

The experiences of the author and others indicate that succinylcholine chloride is a relatively safe effective drug for the purpose of immobilizing many wild animal species. It is apparent that considerable variation exists among species with respect to dosage required to produce the desired effect and margin of safety, which indicates that careful experimentation with each species must be carried out to ascertain the safe effective dosage limits for that species. In highly nervous and fractious individuals, the production of "psychogenic shock" due to fright may be obviated by premedication with tranquilizing drugs 1 to 2 hours before immobilization. This technic will be employed in future trials. Blindfolding the immobilized animal also appears to reduce fear. The availability of equipment to provide artificial respiration in any case where this method of immobilization is employed is strongly advised. The dosages and effects reported in this paper may serve as a guide

for dosage for several species. However, more trials are necessary for each species before firm recommendations on safe dosage can be made.

Summary

Forty-four trials using succinylcholine chloride to produce immobilization through temporary muscle paralysis in 17 species of captive wild animals are reported. It is apparent that there is considerable variation among species with respect to drug dose per pound required to produce complete immobilization and with respect to the margin of safety of the drug. In highly nervous and fractious animals where a risk of death

TABLE 1

Doses and Effects of Succinylcholine Chloride Delivered with Projectile Syringe to Immobilize Several Species of Wild Animals

Trial No.	Species	Total Dose Given and Route	Dose mg./lb. Body Wt.	Time Required To Produce Immobilization	Time Elapsed From Inoculation to Full Recovery and Comments
1	Sika Deer *(Cervus nippon)*	10 mg./I.M.	0.10	5 minutes	25 minutes
2	Mule Deer #1 *(Odocoileus hemionus)*	10 mg./I.M.	0.10	6 minutes	15 minutes
3	Mule Deer #2 *(Odocoileus hemionus)*	10 mg./I.M.	0.10	1.5 minutes	15 minutes
4	Mule Deer #2 *(Odocoileus hemionus)*	15 mg./I.M.	0.15	4 minutes	45 minutes Resp. arrest at 6 minutes, resuscitated by 30 minutes
5	Nilgai #1 *(Boselaphus tragocamelus)*	50 mg./I.M.	0.11	3 minutes	13 minutes
6	Nilgai #1 *(Boselaphus tragocamelus)*	50 mg./I.M.	0.11	2.5 minutes	6 minutes Expired from aspirating vomitus
7	Nilgai #2 *(Boselaphus tragocamelus)*	50 mg./I.M.	0.125	6 minutes	10 minutes expired
8	African Lion #1 *(Felis leo)*	35 mg./I.M.	0.10	8 minutes (partial)	Could move on abdomen
9	African Lion #1 *(Felis leo)*	40 mg./I.M.	0.114	6 minutes (partial)	14 minutes Able to move on sternum
10	California Sea Lion #1* *(Zalophus californianus)*	20 mg./I.M.	0.085	6 minutes (partial)	Became ataxic only
11	California Sea Lion #2* *(Zalophus californianus)*	100 mg./I.P.	0.44	2 minutes	5 minutes Expired
12	Sumatran Tiger #1 *(Panthera t. sumatrae)*	40 mg./I.M.	0.129	7 minutes	Anesthetized when immobilized
13	Springbok #1 *(Antidorcas marsupialis)*	10 mg./I.M.	0.125	3 minutes	8 minutes expired
14	American Black Bear #1 *(Euaractos americanus)*	25 mg./I.M.	0.142	6 minutes (partial)	11 minutes Able to move on abdomen
15	Aoudad *(Ammotragus lervia)*	15 mg./I.M.	0.167	2.5 minutes	25 minutes
16	Alaskan Brown Bear *(Ursus middendorffi)*	75 mg./I.M.	0.10	8 minutes (partial)	Anesthetized with pentobarbital
17	American Black Bear #2 *(Euaractos americanus)*	50 mg./I.M.	0.33	6 minutes	8 minutes
18	American Black Bear #3 *(Euaractos americanus)*	75 mg./I.M.	0.43	4 minutes	10 minutes
19	Spotted Hyena #1 *(Crocuta crocuta)*	7.5 mg./I.M.	0.094	8 minutes	15 minutes
20	Sumatran Tiger #1 *(Panthera t. sumatrae)*	40 mg./I.M.	0.114	5 minutes (partial)	8 minutes Given 50 mg. more in 15 minutes
21	Sumatran Tiger #1 *(Panthera t. sumatrae)*	50 mg./I.M.	0.16	5 minutes	7 minutes

2	Beisa Oryx (*Oryz beisa annectens*)	25	mg./I.M.	0.07	8	minutes	9 minutes expired
3	Mule Deer #3 (*Odocoileus hemionus*)	6.25	mg./I.M.	0.625	10	minutes	25 minutes
4	Springbok #2 (*Antidorcas marsupialis*)	3	mg./I.M.	0.04	No effect, inactive drug		
5	Springbok #3 (*Antidorcas marsupialis*)	3	mg./I.M.	0.033	No effect, inactive drug		
6	American Black Bear #4 (*Euaractos americanus*)	72.5	mg./I.M.	0.36	8	minutes	20 minutes
7	Sloth Bear (*Melursus ursinus*)	72.5	mg./I.M.	0.36	8	minutes	29 minutes
8	Spotted Hyena #1 (*Crocuta crocuta*)	7.5	mg./I.M.	0.10	3	minutes	12 minutes
29	American Black Bear #5 (*Euaractos americanus*)	60	mg./I.M.	0.20	3	minutes	37 minutes
30	American Black Bear #6 (*Euaractos americanus*)	60	mg./I.M.	0.30	11	minutes	32 minutes
31	Axis Deer (*Cervus axis*)	6.66	mg./I.M.	0.067	6	minutes	33 minutes
32	Himalayan Bear #1 (*Ursus tibetanus*)	100	mg./I.M.	0.25	23	minutes (partial)	26 minutes Could move head and legs
33	Himalayan Bear #1 (*Ursus tibetanus*)	120	mg./I.M.	0.30	11	minutes	16 minutes
34	California Sea Lion #3 (*Zalophus californianus*)	10	mg./I. P.	0.117	8	minutes	9 minutes
35	California Sea Lion #4 (*Zalophus californianus*)	20	mg./I. P.	0.20	4	minutes	9 minutes
36	California Sea Lion #5 (*Zalophus californianus*)	40	mg./I. P.	0.40	2	minutes	12 minutes expired
37	Spotted Hyena #1 (*Crocuta crocuta*)	5	mg./I.M.	0.067	No apparent effect, inactive drug		
38	Spotted Hyena #1 (*Crocuta crocuta*)	6	mg./I.M.	0.08	No apparent effect, inactive drug		
39	Spotted Hyena #1 (*Crocuta crocuta*)	8	mg./I.M.	0.107	No apparent effect, inactive drug		
40	Fallow Deer #1 (*Dama dama*)	8	mg./I.M.	0.10	2	minutes	50 minutes Resp. arrest at 9 minutes
41	Fallow Deer #2 (*Dama dama*)	5	mg./I.M.	0.10	1	minute	34 minutes
42	Fallow Deer #3 (*Dama dama*)	10	mg./I.M.	0.08	5	minutes	23 minutes
43	Fallow Deer #1 (*Dama dama*)	5	mg./I.M.	0.062	3.5	minutes	13 minutes Expired, resp. arrest at 10 minutes
44	North American Elk (*Cervus canadensis*)	20	mg./I.M.	0.04	3	minutes	31 minutes

*Field trial on free wild animals in native habitat.

due to shock secondary to fright produced by the immobilization exists, the administration of tranquilizers prior to immobilization is suggested. Immediate blindfolding after immobilization is also of value.

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Small Animal Clinic

Pseudomonas Infections an Increasing Hazard

An increasing number of medical reports indicate that severe bacterial infections and deaths caused by *Pseudomonas aeruginosa* are increasing. The growing incidence among humans is caused by antibiotic-resistant strains of this organism. Medical reports indicate that fatalities from Pseudomonas and related bacteria have risen 4-fold since 1949. The National Office of Vital Statistics reports that infectious disease now ranks 4th among the chronic disease killers in the United States. Only heart disease, cancer and cerebral hemorrhage rank ahead of it.

Classification of strains of the Pseudomonas family is difficult because of their variety and wide range of activity. *Pseudomonas aeruginosa* is the only pathogenic member of nearly 150 species of the genus. The organism was first reported in a blood culture in 1896.

The Pseudomonas organism not only flourishes in water and soil, but is also a common contaminant of the human skin. It adapts itself to liquids, existing even in antiseptics. It has been cultured from presumedly sterile solutions of distilled water, ophthalmic preparations, germicides, and procaine and penicillin solutions. Pseudomonas has been found in air-cooling and humidifying equipment in hospitals. Debris in faucet aerators was the source of a Pseudomonas infection in one hospital nursery. Nearly every region of the body is susceptible to Pseudomonas infection, and Pseudomonas infections are being found much more often. Dr. Maxwell Finland of Harvard Medical School reported in 1959 that the efficacy of antibiotics has generally been overshadowed by the increased pathogenicity of infectious organisms such as Pseudomonas. These organisms had not been considered serious disease producers and had only infrequently caused fatal infections before the era of antibiotics.

Coly-Mycin Injectable is a new antibiotic that is available for severe acute and chronic urinary tract infections due to strains of Gram-negative organisms. It is now available from Warner-Chilcott Laboratories, Morris Plains, N.J., after extensive clinical studies. Coly-Mycin has been found to be especially effective against Pseudomonas that are commonly resistant to most other antibiotics. It has a distinct therapeutic value against *E. coli, Aerobacter aerogenes, Klebsiella pneumoniae and Brucella.*

Radiograph Stain Remover

Stains caused by radiograph film developer can be easily removed from the skin by application of a potassium permanganate so-

lution, followed by a rinse first in sodium bisulfite solution and then in clear warm water, writes Ralph Tarrant, A.M.A. consultant, in a reply to a query from a Washington, D. C. physician.

The first solution consists of 7 gm. of potassium permanganate dissolved in 1 liter of water. The second solution is composed of 454 gm. of sodium bisulfite dissolved in 1 liter of water. The solutions should be kept in labeled bottles ready for use.

Stains on white fabrics can be prevented if the chemical is removed thoroughly before it has a chance to decompose, which may occur on standing or in the laundering process. Even if the stain has formed, the garment should be rinsed before laundering to prevent possible intensification. Yellow or brown stains due to oxidized developer can be removed by treatment with an acid permanganate solution followed by a bisulfite bleach. While this is effective in removing developer oxidation stains, it may weaken the fabric and should be applied to white garments.

Jour. Am. Med. Assn., 176:478 May 6, 1961

Management of Luxations

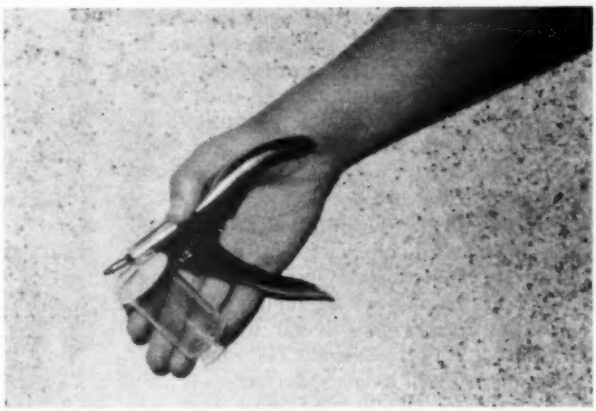
Luxations are a phase of orthopedics that should be reduced as rapidly as possible. Any coxofemoral luxation that can be reduced readily is done immediately. An ultra-short acting anesthetic is adequate for reduction of the coxofemoral luxations. The leg is then put in a butterfly bandage.

Elbow luxations are more difficult to handle. It is necessary to use a longer acting anesthetic.

The Mathis splint can be used to handle the mandibular occipital luxations.

The anterior and posterior cruciating ligaments are prone to ruptures. Carpal and tarsal luxations generally rupture ligamentous structures that maintain these joints. All these luxations, with the exception of shoulder and hip luxations, can be immobilized with a Mathis or Thomas splint.

Luxation or joint injuries can be the start of arthritis. Arthritis starts as a result of abnormal wear. If the dog uses the injured joint, the articular surfaces become inflamed.



When clipping nails with the Resco trimmer, there is a tendency for clippings to scatter around the room. Dr. S. L. Coates, Shirley Center, Mass., has removed the guide plate of a standard trimmer and placed the cap from a plastic pillbox under these screws. A small hole is cut in the cap, which lines up with the hole in the guide plate. When the screws are tightened, the cap is held in position under the guide loop. The body of the pillbox is placed in position and nail clippings drop into the container. Clinical tip supplied by W. F. Martin, Syrall Manufacturing Co.

Use of Hypothermia In Cardiac Arrest

Early application of hypothermia (31 C.) affords protection against the cerebral damage resulting from cardiac arrest, reports Kenneth B. Wolfe of the Claude Beck Cardiovascular Research Laboratory, Western Reserve University School of Medicine, Cleveland, Ohio.

Cerebral damage was produced in 20 normal dogs by a five-minute period of ventricular fibrillation followed by resuscitation. Ten dogs were maintained at normal room temperature and ten were cooled to 31 C. then maintained at this temperature for 24 hours following resuscitation. All ten uncooled dogs died. Three of the ten cooled dogs survived without cerebral damage and four of the cooled dogs had their lives prolonged.

The investigator suggests that early use of hypothermia should be applied to all cases of resuscitation in which brain damage is suspected or definitely observed. This technic extends the applicability of resuscitative procedures.

Cooling was started by pumping an antifreeze solution at a temperature of 10 F. through the tubes of a rubber blanket placed under the dog at the beginning of the procedure. It usually required two hours to lower the rectal temperature to 31 C. and it was then maintained at that level for 24 hours. A continuous recording thermometer was used to record the rectal temperature. As soon as the chest closure was completed, a top blanket was placed on the dog. Shivering was controlled by frequent doses of meperidine or morphine and Phenergan® or Thorazine®. Gradual rewarming started at the end of 24 hours and continued until the dog's rectal temperature reached 38 C. A tracheal tube, which had been left in place to maintain an open airway, was removed at this point and the dog was returned to his cage.

The control dog was operated on in the same manner and was kept on the operating table under the same conditions as the hypothermic dog, but at room temperature.

There were ten controlled experiments involving 20 normal dogs. The series showed some degree of protection against cerebral damage in 70% and complete protection in 33.3% of the animals.

Am. Jour. Cardiol. 6:809, (October), 1960

Fungal Flora Of the Canine Ear

Molds were comparatively rare in the external ears of 35 healthy dogs and of 277 dogs suffering from otitis externa examined in this study. The commonest species isolated were *Aspergillus, Penicillium, Absida* and *Rhizopus.* These were equally prevalent in healthy and infected ears. *Aspergillus fumigatus* was the species most frequently found in healthy ear canals, but was also found in only 2% of the infected ears. This indicates that it as well as other molds are probably not pathologically important.

The yeasts were isolated from less than 5% of the healthy and infected ears. Three cases of acute mycotic otitis were encountered in this survey that were caused by the *Candida* sp. and all were in animals that had been on prolonged antibiotic therapy.

Incidence of *Pityrosporum* species was similar in the ears of healthy and infected dogs. These species may be of etiological significance in otitis by causing irritation.

Dermatophytes were not recovered from the 35 clinically healthy dogs nor from the 277 dogs suffering from external otitis examined in this study.

G. Fraser, Jour. of Comp. Path. and Therap., 71:1, 1961.

Large Animal Practice

An Effective Non-Antibiotic Treatment for Bovine Mastitis

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Practitioner
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Mandelamine, a combination of mandelic acid and methenamine, has been extensively used for management of urinary tract infections, but its use in treatment of bovine mastitis has not been reported. It is effective against the common urinary tract invaders: *E. coli, Staph. aureus, Strep. fecalis* and some other strains. *Proteus vulgaris, Aerobacter aerogenes* and *Pseudomonas aeruginosa* are often resistant to mandelamine, but not more so than to other available antibacterial agents.[1]

About 1,000 doses of mandelamine have been used to date in treatment of bovine mastitis. Generally, the response to this drug has been very rapid and satisfactory in problem cases of mastitis if the organism was sensitive *in vitro*. A few cases have been found that did not respond well. These were in quarters that had already undergone considerable fibrosis. Other individual cases within herds that did not respond well to mandelamine were successfully treated with neomycin or Chloromycetin.

This report deals with a herd of 50 Holstein cows that had a resistant type of mastitis. Treatment with any of the available mastitis preparations had been unsuccessful for several years. Since the advent of penicillin, each new antibiotic or sulfa had been tried in this herd with unsatisfactory results.

Mastitis in this herd first appeared as a yellow discoloration of milk. This was followed by a hardening of the infected quarter or quarters. The quarter or udder would slowly atrophy following this infection if the cow did not die within 6 to 8 days after initial symptoms of mastitis. There had been about a 25% yearly turnover of cows in this herd from the endemic resistant mastitis.

Sensitivity testing revealed that mandelamine was the only drug which would inhibit this organism, a Gram-negative rod that could be isolated in nearly pure culture from these cases of mastitis.

Mandelamine was tried on these infections. When used in the early stages of the mastitis, (before the quarters hardened), the response was good. There were no more fatalities from mastitis infections in this herd for a 12-month period following the use of mandelamine treatments. The amount of drugs used and the number of cases of mastitis have been reduced to about 1/10 that of previous years. Now that this infection is controlled, it has been possible for the owner to cull carrier cows and those

with atrophied quarters. Approximately 150 doses of mandelamine have been used in this herd.

One gram of mandelamine is mixed with 100 cc. of oil in water mastitis emulsion. About 20 cc. of this preparation is used as an udder infusion. Usually 1 or 2 doses is sufficient to control the infection. Doses larger than 20 cc. do not seem to cause any undesirable reaction, but are not necessary.

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Management of Bovine Retained Placenta

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About 10% to 15% of all bovine parturitions are accompanied by retained fetal membranes. In cases of abortion, abbreviated pregnancy and twinning the percentage is nearly 100%. The fetal membranes are usually expelled within 6 to 8 hours following parturition. If they are not expelled, the mass is usually obvious and seen protruding from the vulva.

Veterinary intervention in this condition is probably influenced more by personal preference than by careful deliberation. The following program for management of retained placentas has been followed by the author for a period of 4½ years. These cows were part of a large 1,000 cow herd in which all herd health services and artificial inseminations were performed by the writer. This made it possible to be in daily contact with the herd.

The maternity barns were visited each morning and every cow that had calved during the preceding 24 hours but not definitely known to have expelled the fetal membranes was examined. If the placenta was retained, an attempt was made to remove it. When it was found that the fetal membranes could not be removed without causing injury to uterine tissue, the uterus was medicated and removal attempted the following day. A 48-hour delay or longer before attempting removal of fetal membranes may result in difficult passage or impossibility of passing the hand through the cervix without tearing the musculature as it begins to contract by this time. For this reason, a delay of 2 to 3 days may constitute a disadvantage. Of more significance is the fact that retained fetal mem-

branes left unattended for longer periods of time undergo considerable decomposition. Septic products are produced within the uterus which increase the osmotic properties of the contents, resulting in accumulation of large quantities of fluid. These septic products cause dehydration, toxicity, or even a septicemia. Approximately ¼ of all cows with retained fetal membranes exhibit severe signs of illness while the rest show no marked symptoms. Yet there is an economic loss due to reduced appetite and body weight, lowered milk production and impaired fertility.

A review of the literature does not indicate any sound reasons for delaying competent veterinary intervention. On the other hand, a great service can be rendered by early intervention. The placenta should be removed and the uterus medicated within 24 hours following parturition if it is possible to remove it without causing tissue damage. If it is evident that early attempts to separate the caruncles from the cotyledons will cause uterine injury, the veterinarian should explain this to the client, medicate the uterus and make a repeat call within several days. During the second call the veterinarian should check the health of the cow, attempt to remove the membranes and place more medication in the uterus.

A second point of interest in this regimen is the choice of uterine medication. In the past, boluses containing everything and especially urea may have been useful when intervention was delayed several days and the placental mass had undergone considerable decomposition. The use of broad-spectrum antibiotics alone will limit bacterial multiplication and placental decomposition. Gelatin capsules (1 or 1½ oz.) containing 1 gm. to 3 gm. of tetracycline placed in the uterus with a retained placenta shortly after parturition will prevent much tissue decomposition. This greatly reduces the ill effects of retained fetal membranes and will justify a repeat call if the membranes cannot be removed initially. For the dairyman this means improved health of the cow and increased milk production.

Oral Glucogenic Compounds For Bovine Ketosis

Lactates, propionates and propylene glycol are some of a series of chemicals that through their indirect action are used both as preventive and therapeutic agents for bovine ketosis. They have a glucogenic action when administered orally to ruminants.

Comparative acceptance data shows that most of these glucogenic compounds are not sufficiently palatable or have physical or pharmacological properties that limit their use. Palatability is an important factor because medication via the feed is the preferred method of administration. Of these various glucogenic substances, mixed lactate salts (calcium-sodium lactate) are the most palatable and do not have undesirable side effects. A practical form of such mixed lactates can be obtained by the lactic acid fermentation of whey in which the calcium to sodium ratio has been adjusted for maximum palatability for the cow. The unfavorable flavor characteristics of calcium lactate are masked by the sodium lactate.

Sodium lactate increases the blood glucose more rapidly than calcium lactate, with a consequent reduction in ketone bodies. This occurs because an appreciable amount of orally administered sodium lactate is converted to propionic acid by the rumen microorganisms. However, rapid clinical response to sodium lactate is often followed by relapse in about 48 hours because of a severe laxative effect of sodium lactate. But a mixture of calcium-sodium lactate eliminates this laxative side effect.

The strength of lactate salt preparations depends on their equivalent lactic acid content. The suggested dosage in terms of this active ingredient is: feed medication, 0.3 lb. to 1 lb. lactic acid equivalent daily; drenching, 0.75 lb. lactic acid equivalent per drench administered twice daily. Mixed lactate salts are acceptable and effective when fed at the rate of 6% to 10% of the concentrate mix. Prolonged feeding under farm conditions at this rate did not produce any adverse side effects during a 3 month

period. After the 3rd feeding 95% of the cows accepted rations which contained the above amount of mixed lactate salts.

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Disease Resistance In Baby Pigs

It has long been known that the newborn pig receives most of his disease resistance via his mother's colostrum. Research at the Iowa Station shows that there is a 50% decrease every 3 hours after farrowing in the ability of the baby pig to absorb the disease-protective antibodies from his mother's colostrum. Both the Iowa and Michigan Stations have demonstrated that the baby pig between 2 and 5 weeks of age has a very low disease resistance.

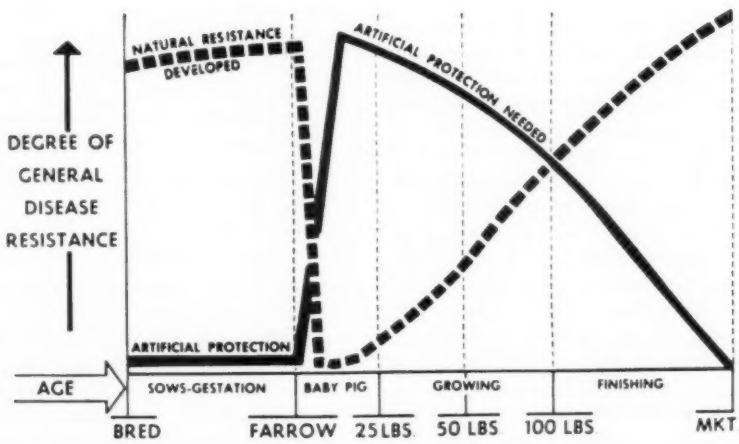
After the first 2 days, when nursing his mother, the baby pig is able to absorb very little, if any, of the antibodies from his mother's milk, and/or is physiologically unable to develop his own antibodies. He is physiologically unable to develop his own antibodies until about 5 or 6 weeks of age. It is during this period, from 1 or 2 weeks of age up to 5 or 6 weeks of age, that the baby pig is most susceptible to all kinds of stress factors, including disease.

Therefore, he needs the greatest artificial protection during this period. This is a very important and basic concept in the application of nutrition, utilizing both nutrients and additives, and in the application of veterinary practices and technics (*i.e.* utilization of the SPF pig technic). It is also during this period from farrowing to 25 lb. that the greatest returns come for investments in good management and a well-controlled "pig-engineered" environment (housing and equipment).

Damon V. Catron, Ph.D.
Walnut Grove Products Co.

The figure below shows the degree of general disease resistance of different ages of swine. It is known that older sows have a relatively high, natural resistance to disease.

EFFECT OF AGE ON GENERAL DISEASE RESISTANCE



Guest Editorial

Needed—Veterinary Parasitologists

This Editorial Points Out the Lack Of Trained Veterinary Parasitologists And Offers Remedial Measures

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The conditions involving any science are certainly much more complex now than they were 25 years ago. There are many related phenomena that have changed or been created to bring this about. It seems that at the present time the many stimuli to which one is subjected in a year is equal in number to those of a period of 5 or 10 years some 15 or 25 years ago.

These things are sometimes disconcerting if one believes that in spite of all the gadgets and material wealth there is still no substitute for work, perseverance and learning in gaining professional accomplishments. It is high time that we consider dynamic changes in our thinking, behavior and procedures in relation to our biological disciplines. A quotation attributed to Vice-Admiral Rickover sums up very well the present-day educational dilemma: "It takes just about 30 or 40 years to change an educational system. We live in an era when it is very easy to get food and clothing. They come to us almost naturally and so we believe that things of the mind can come that easily too. This is where we fall down. This is the most serious problem facing the United States."

It is obvious that there has been a great dilution of the individual's time that can be devoted to any one thing because of an increased number of interests, especially if the responses to these interests have been allowed to take their course uninhibited. Therefore, anyone in the scientific field must make decisions calculated to restrict some general interests. He must direct an adequate amount of time to pursue his science to the extent of making it a major undertaking rather than a side line from which to draw subsistence.

In spite of all our advancements as a

democratic society, there are faults that the potential career man in parasitology, whether in research or teaching, seriously questions. These concern the instabilities of finances and advancement in position, and undesirable changes in the kind of work in a position. A study of these potentials by the American Association of Veterinary Parasitologists should be rewarding.

There are several basic causes for the dearth of veterinary parasitologists and professionals in other medical disciplines. (1) The 6 years (at least) of college training required to become a veterinarian are strenuous; mentally and physically fatiguing. There may be additional economic strains. During this period the student usually has an acute interest in his future profession, but the expression of his ability except mentally is of necessity thwarted, with a resulting psychological strain. It is not difficult, therefore, to understand why student veterinarians want to express themselves and be freed from a student status. (2) The ceaseless progression of new equipment and devices is sometimes discouraging to one returning to a graduate student status, for it takes time to fathom new technics if they are to be used as something not foreign to the procedures in accomplishing an end. Even the increase in the complexity of the microscope produces difficulties. All such specialized equipment is not technically perfect and failures produce frustrations, delays and losses. (3) The amount of literature in our field and the accelerated rate of its increase is stifling. This should give the trainee as well as the parasitologist much concern, whether he realizes it or not. Our attitude towards this literature will determine whether we shall have a science or pseudo-science and whether we turn out practicing veterinarians or professional quacks. Other departments, of course, will make their contribution to one or the other. (4) Instruction and research in the treatment phase of parasitology cannot be ignored. If anyone still thinks changes have not taken place, let him consider anthelmintic and insecticide compounds.

We used to have a science of pharmacology, and the pharmacologist was a master of drugs. Now drugs, under proprietary names, are our masters, apparently out of control and partially in the hands of competing commercial companies. Recent publications indicate that the medical profession does not know how to handle the problem either.

We are concerned with anthelmintics, protozoacides and insecticides. The pace and change of these are so fast that if we could keep up with one or the other, we would not know what to do or what to believe. Most of us have faith in the integrity of companies producing and selling the products, but nevertheless, they have made mistakes. Consequently, an individual teacher in a veterinary college wants to see some results by independent investigators, and he wants to know who they are before recommending a new product. The reason is that some companies are asking personnel in agencies such as animal husbandry and agriculture departments to test anthelmintic drugs for them. Such assignments have been accepted and testing completed by individuals who had no idea of a parasite, the conditions necessary for an evaluation or the technic for examining an animal. These companies are faced with difficult research problems, but there should be no excuse for such procedures. To determine the value of a compound as an anthelmintic, protozoacide or insecticide is one of the most difficult and expensive of research projects.

The biology of parasites needs to be given attention. On the basis of isolated experiences and the almost spectacular results, mostly from work by Australian veterinary parasitologists, it is evident that we are just waking up to the fact that we have barely scratched the surface in understanding this phase of our science. When the biology is understood, there is evidence that the benefits of better, and in some cases, even spectacular control should be in the offing. Parasitology is a very important science and it is interesting to see how many times it is ignored as an entity when popular declarations are made for funds in biological sciences.

From information available, it appears that in most academic institutions where

parasitology is taught as an entity, a single course is still relied on as a background for all parasitological work. This is certainly an unfortunate circumstance in this day and age. Furthermore, some of the courses are exceedingly poor and out of date. They seem to be taught with the idea of anything to get by, or by excusing deficiencies of training and experience. There should be 2 or 3 courses in parasitology in the academic curriculum, depending on the organization. These are not dogmatic requirements but ones necessitated by the development and evolution of this science. For proper training, a student parasitologist in any category who is seeking a master's or Ph.D. degree should certainly be subjected to more than one parasitologist in his training.

We realize now that every practicing veterinarian should have a substantial knowledge of parasitology if he is going to handle cases of parasitism properly and use protozoacides, anthelmintics and insecticides to best advantage. If all veterinarians could "talk sense" to their clients concerning parasitism (the sources of parasites in the host, conditions of spread and the gospel of prevention), it would pay them in good will, confidence, and even financially, because there would be more and healthier animals. This would help to bring about a higher economic level among their clients.

Many of the conditions referred to could be offset by considering certain attitudes and conditions regarding the curriculum in veterinary colleges. Unfortunately, there are too few individuals who understand the problems in veterinary parasitology. Conscientious veterinary parasitologists who are teaching are literally floored in devising methods and securing sufficient materials and time to teach veterinary students enough to get along in practice. When one considers these phases, he realizes that the services of a technician trained in parasitology are indispensable but that such individuals are practically nonexistent.

Observations of graduate veterinarians and veterinary students over a period of the last 5 or 6 years seem to indicate that in many instances they know very little about parasitology. There are various reasons for this. (1) It seems that sometimes after they have finished with a course in parasitology they are discouraged by other individuals in making use of or improving their knowledge. (2) In some instances the teaching of parasitology is merely a mechanical process, because the training and experience of the instructor are inadequate or he has too limited interests. (3) In other instances the potential teacher is loaded with more research than he can do and in addition perhaps has service work to do also. (4) Students often have to acquire information only from lectures, making it impossible to get an adequate outline of the subject. (5) Veterinary parasitology too often is considered as only another course in the curriculum rather than a whole science to be presented, justified and integrated with other disciplines.

We have research workers in parasitology and we have parasitologists. This is no reflection on the research worker, but it should be indicated that it is less difficult and requires less training and experience to become a research worker. In many departments we have people with inadequate training as teachers, too few individuals to do the teaching, with too little equipment and materials and under conditions of too little time. There are really no directional motives in the field of veterinary parasitology and there are not enough individuals with adequate training and experience who have sufficient time to present the situation to state, national or professional groups for proper consideration and evaluation. This is a tremendous problem and should demand the attention of organizations interested directly and indirectly in parasitology. Just how many parasitologists could tell an administration the conditions that exist, what is needed in parasitology to insure a balanced curriculum and what is necessary to properly and adequately train the practicing veterinarian, so that he can use his knowledge efficiently to combat parasitism? Recommended changes will require an evolution in this science, with more attention given to it and a more critical evaluation made by better trained and experienced parasitologists.

Proposed Changes

From the standpoint of keeping up with the science, teaching and doing research, there must be departments of veterinary parasitology, each manned by more than one individual. Such departments must exist, for the reason that disciplines not having direct contact with a fiscal officer in our type of organization will have a number of difficulties.

The principal member of the parasitology department in a veterinary college should have the training of a veterinarian, a Ph.D. in parasitology or a master's degree in both public health and parasitology, with some experience in teaching and research as well. All department members should have had other parasitology courses in addition to a background course in veterinary parasitology. Department members should have speciality training whether or not they have a D.V.M. degree. A well-trained man without a professional degree would be a very valuable asset to any veterinary parasitology department.

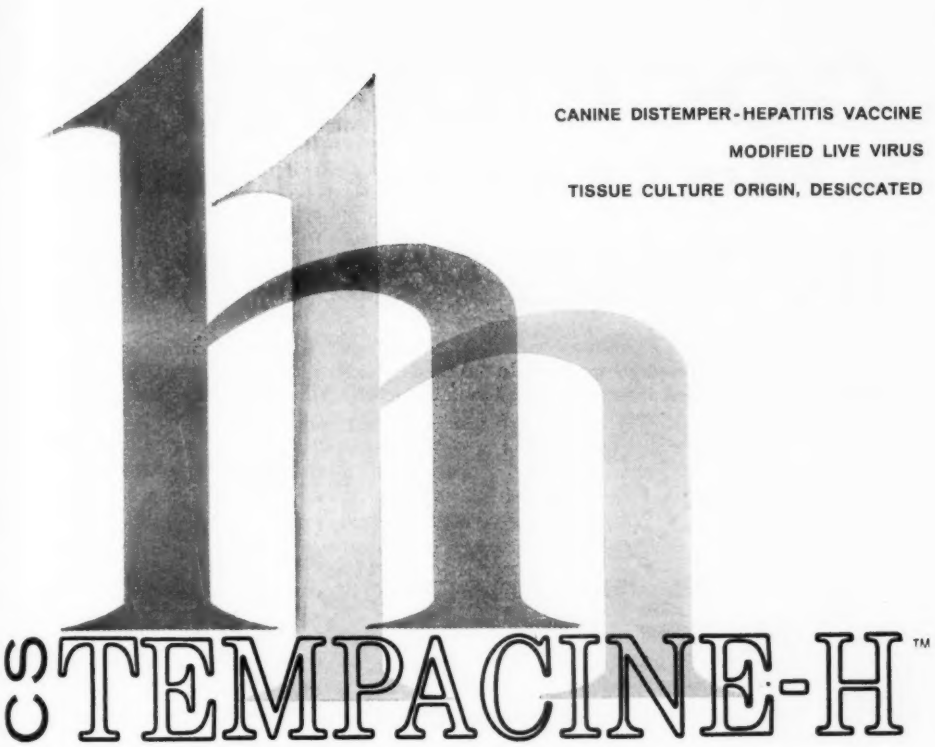
Parasitology is an exceptionally broad science and can be organized from a number of standpoints. But from whatever standpoint it is organized, there must be a division of labor among individuals in the department with a balance of academic and clinical phases. If the academic phase is ignored, the graduating veterinarian has nothing to put into practice and if the clinical phase is ignored, he is seriously handicapped in practice. There is not sufficient time in the formal course work to present enough of the practical aspects of the subject. This needs to be considered an area in which improvement can be made. We should be concerned with showing the students the value of diagnostic conclusions rather than diagnostic impressions. It is absolutely essential in the training program of a veterinary student, however, that a veterinary parasitologist direct students in the clinical phases of the profession. This would benefit and strengthen many of the clinics, and set the members of the parasitology department at ease as to the future use of the information derived from their efforts in the classroom. If such a development and change could be brought about, general veterinary practice would be improved and the veterinarian would be aided in gaining the confidence of his clients.

With some changed conditions of training for veterinary parasitologists, more projects could or would be devised to increase the training, capacities and abilities of parasitologists. Certainly there must be many projects that could be readily done by a graduate student or a nontechnical or semitechnical individual trained to do a routine job. It should be possible to find more problems that would tax the mental capacities of a talented individual and produce some new and fundamental concepts. What kind of research we do now and in the future will determine the scientific worth of our profession. All of this is based on the proposition of how well we teach students.

Veterinary parasitology, of course, is in the embryonic state of development. The academic pinnacle of the past in general parasitology has never been attempted in veterinary parasitology. This certainly should at least be a goal to strive for in improving the training of the veterinary practitioner.

Our science has a dead-pan expression and it is going to take effort, much time, an increased number of trained personnel for teaching and research, increased funds and facilities, a conciliatory attitude of administration, support of the A.V.M.A., and an organized campaign based on logic and reason to secure proper recognition.

And lest we forget, it should be mentioned and remembered that most of what we know about the parasites of domestic animals in this country has been produced by parasitologists outside of the veterinary profession. While we must not fall for the idea of thinking that any individual with a veterinary degree can teach parasitology in a veterinary college or do basic research in the subject, it is high time that we train individuals within our profession to work alongside with these other parasitologists.



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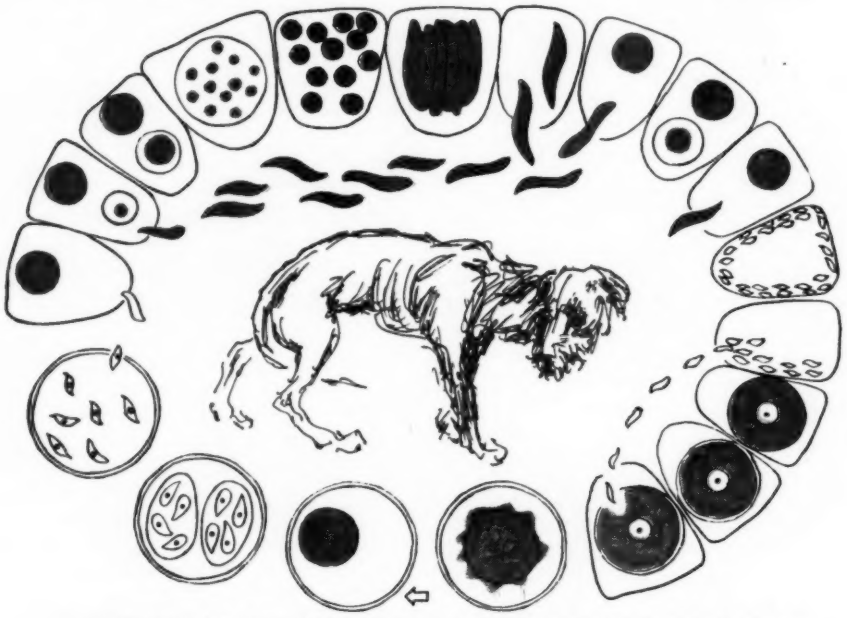
COCCIDIOSIS:
"a very common infection"
IN THE CANINE

Coccidiosis in the dog has been shown to be quite common.[1,2] Since coccidia may cause death in heavily infected young animals,[3] an understanding of this potentially serious disease should prove of interest to the veterinarian with a small animal practice.



ADAPTED FROM: MORGAN, B. B., AND HAWKINS, P. A.: VETERINARY PROTOZOOLOGY, BURGESS PUBLISHING COMPANY, MINNEAPOLIS, MINN., 1952.

The Classical Cycle of Isospora bigemina. The coccidia undergo repeated cycles of asexual multiplication (schizogony) finally terminating in formation of sexually differentiated *gametes*, which combine to form *zygotes*. At this stage a protective covering is formed. Sporulation (sporogony) may occur within the intestinal tract or after the oocyst is discharged in the feces of the host, depending upon the stage of the infection. When ingested by a new host, the *sporozoites* escape from the oocyst and enter the intestinal epithelium to repeat the cycle.

The Classical Signs of Coccidiosis. The predominant signs of coccidiosis in severe cases are bloody diarrhea, general weakness, anemia and rapid progressive emaciation. Oocysts will usually be found in the feces 5 to 6 days after the infection begins. The animal is depressed and weak and loss of appetite may be observed. It is important to note that at the outset of signs "coccidiosis may occasionally be confused with distemper."[2] Since the disease may be rapidly progressive, early therapeutic measures are necessary to improve the dog's chances for survival.

NOW
A Control for Canine Coccidiosis...

FURADEX, containing FURACIN® (brand of nitrofurazone) in an excipient of dextrose for peroral therapy, is *anticoccidial* in addition to being antibacterial. In one series, FURADEX "rapidly cleared up" the diarrhea of canine coccidiosis. Within 10 days, "stools were negative for coccidia, and they were still negative when reexamined two to three months later."[4] A confirmatory study indicates "FURADEX produces excellent results." Clinical signs were eliminated in 89% of cases. Animals treated with FURADEX "showed an earlier clinical response and the stools became negative for coccidia in a shorter period of time."[5] According to a recent report, FURADEX provides "excellent anticoccidial activity."[6]

as well as for Bacterial and Nonspecific Diarrheas

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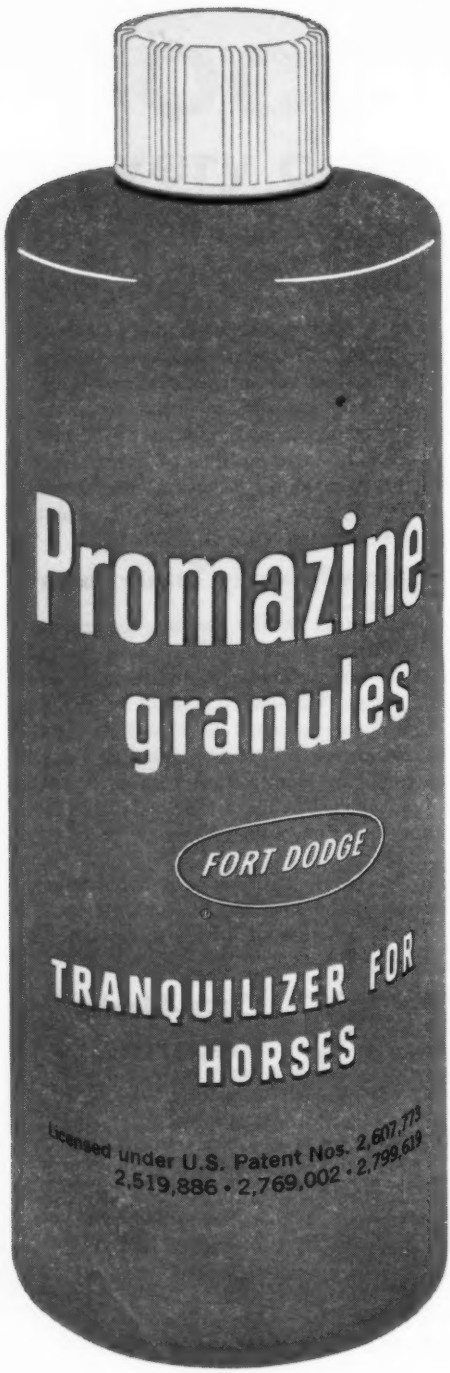

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Clinical Research

Benzethonium Chloride for Inactivation of Erysipelas Organisms

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Inactivating agents to be useful in the preparation of bacterins or vaccines should completely destroy the infectivity of an organism without excessively damaging its antigenicity.

Historically, formalin has been the most extensively used inactivating agent in bacterins and vaccines. Formalin does, however, have certain disadvantages in that it can damage antigenicity.[1,2,3,4,5]

Domagk[6] in 1935 introduced quaternary ammonium compounds as a general and medicinal disinfectant. These are odorless, colorless, highly stable, relatively nontoxic and contain no phenol, iodine, chlorine or heavy metals. They are equally effective against many Gram-positive and Gram-negative bacteria.

Little or no work has been done to use them as inactivating agents for the preparation of bacterins or vaccines. Therefore, this investigation was initiated to study the antigenicity of *Erysipelothrix rhusiopathiae* inactivated with 0.4% formalin and with the cationic quaternary ammonium compound benzethonium chloride (Inactisol,® Diamond) — (di-isobutylphenoxyethoxyethyl dimethyl benzyl ammonium chloride) —hereafter referred to simply as benzethonium.

E. rhusiopathiae Bacterin: All cultures of *E. rhusiopathiae* were prepared using strains R2, SE9, CN3342, CN3461 and AN4

TABLE 1

Inactivation of *Erysipelothrix rhusiopathiae* with benzethonium at 37C. and at Room Temperature (R. T.)

Final Concentration of *Inactisol*	*Growth of Erysipelas Obtained From Cultures After**					
	18 hrs. at		*90 hrs. at*		*10 days at*	
	37C.	R.T.	37C.	R.T.	37C.	R.T.
1: 1,000	-	-	-	-	-	-
1: 5,000	-	-	-	-	-	-
1:10,000	-	+	-	-	-	-
1:20,000	+	++	+	++	+	+
1:40,000	++	+++	++	++	++	++

*Growth was measured empirically after streaking 0.5 ml. samples on blood agar plates.

TABLE 2

Comparison of Antigenicity of *E. rhusiopathiae* Cultures in Mice after Inactivation with Formalin and Benzethonium

Immunizing Culture		Surviving Mice/Total Mice Injected at the Indicated Levels of Immunization Seven Days Following Challenge			
		1:80 Dilution	1:240 Dilution	1:720 Dilution	Totals
Benzethonium (1:10,000) Inactivated	1	14/16	11/16	8/16	33/48
	2	13/16	14/15	6/14	33/45
	3	8/11	14/18	7/14	29/43
	4	17/20	8/20	6/17	31/57
	5	8/10	4/10	4/10	16/30
	6	17/20	12/20	7/20	36/60
	7	10/20	6/20	4/20	20/60
	8	15/16	11/16	10/16	36/48
	9	14/16	11/16	3/16	28/48
	10	15/16	9/16	3/16	27/48
	Totals	131/161	100/167	58/159	289/487
Formalin (0.4%) Inactivated	1	10/16	5/16	1/16	16/48
	2	13/16	13/18	8/19	34/53
	3	13/16	13/18	8/19	34/53
	4	14/20	8/20	6/20	28/60
	5	6/10	0/10	0/10	6/30
	6	15/20	4/20	3/20	22/60
	7	5/20	1/20	1/20	7/60
	8	10/16	7/16	2/16	19/48
	9	11/16	7/16	2/16	20/48
	10	13/16	7/16	1/16	21/48
	Totals	110/166	65/170	32/172	207/508

grown in a horsemeat infusion broth containing essential salts, 5% dextrose and 10% horse serum. The cultures were grown at 37 C. for 48 hours, then pooled and divided into equivalent aliquots for inactivation with benzethonium or formalin (37% formaldehyde). Tricalcium phosphate (Neojel,® Diamond)[7] was added then as an adjuvant and to concentrate the cultures to 13.3% of their original volume.

E. rhusiopathiae Challenge Strains: The swine challenge strains of *E. rhusiopathiae* were HC585, S192, 422-1 and NF4. These strains have been successfully used previously.[8,9] The challenge strain of *E. rhusiopathiae* used for mice was EW_2. The use of this strain for this purpose has been previously reported.[7]

Mice: Swiss white mice weighing 16 gm. to 20 gm. were used on all mouse potency tests.

Swine: Erysipelas-susceptible Hampshire pigs weighing 38 lb. to 50 lb. were used on all swine potency tests. Herd susceptibility was determined prior to use by means of skin scarification challenge.[8,9,10,11]

Experiment 1: In order to determine the lowest concentration of benzethonium that would inactivate the *E. rhusiopathiae* culture at 37 C. and at room temperature, a pooled culture was divided into 5 equal aliquots and treated as follows: Benzethonium was added to each of the 5 aliquots to obtain final concentrations of 1:1000, 1.5000, 1:10,000, 1:20,000 and 1:40,000. Each of the 5 aliquots was divided then into 2 equal parts. One part was incubated at 37 C. and the other incubated at room temperature. Test samples were removed from all cultures at 18 hours, 90 hours and 10 days. The samples were checked for viability by streaking on blood agar plates and by inoculation into liquid thioglycollate medium.

It can be seen that the *E. rhusiopathiae*

is inactivated faster at 37 C. than at room temperature (Table 1). Benzethonium at a dilution of 1:10,000 or less inactivates the culture within 18 hours at 37 C. and at room temperature.

Experiment 2: Several experiments were set up to compare the immunogenicity of *E. rhusiopathiae* culture inactivated with a final concentration of 0.4% formalin and 1:10,000 dilution (0.01%) benzethonium. These tests were conducted in mice by means of an antigen extinction test based on the "potency test for erysipelas bacterin" as set forth by the U. S. Department of Agriculture.[12]

The test is read by recording the surviving mice 7 days following challenge. The combined results of a series of such experiments are summarized in Table 2. This data shows that the inactivation of *E. rhusiopathiae* cultures with a 1:10,000 final dilution of benzethonium resulted in a better antigen than corresponding cultures inactivated with a final concentration of 0.4% formalin. It may be seen from Table 2 that the bacterin inactivated with benzethonium protected a total of 289 mice out of 487 (59%) while the bacterin inactivated with formalin protected only 207 mice out of 508 (41%) immunized and challenged.

Experiment 3: This experiment was designed to repeat the above results (obtained in mice) in erysipelas-susceptible swine. An erysipelas-susceptible herd of 92 mixed breed swine, approximately 8 weeks old, were used on this test. Twenty-seven were immunized with a 2 ml. dose of Lot 9, formalin-inactivated bacterin, 45 were immunized with a 2 ml. dose with Lot 9, benzethonium-inactivated bacterin and 27 were left unvaccinated to serve as controls.

The animals were divided into groups and their immunity challenged at 2 weeks, 4 weeks and 11 weeks by the skin scarification method of Fortner and Dinter.[8,9,10,11] At 48 hours the 4 scarification marks on each animal were examined and the reaction recorded in the following manner: R—Severe, r—mild, O—no reaction. These studies on swine confirm the immunological studies obtained in the previous experiments in mice. It may be seen (Tables 3 and 4) that while both bacterins immunized swine, the bacterin prepared with benzethonium conferred a stronger immunity. This is indicated by the smallest percentage of R reactions occurring on these swine following challenge at the various intervals of time between immunization and challenge.

Experiment 4: Experiments 2 and 3 indicated that the benzethonium-inactivated erysipelas bacterin was more potent in mice and pigs than the formalin-inactivated bacterin. It was assumed that this was due to a greater denaturing effect by formalin on the antigen; however, the possibility existed that the benzethonium might be acting as an adjuvant. An experiment was designed to check this possibility. A lot of formalin-inactivated *E. rhusiopathiae* bacterin was divided into 2 parts and benzethonium was added to 1 part. Both preparations were then concentrated with tricalcium phos-

TABLE 3

Comparable Resistance* of Swine Challenged Two Weeks after Vaccination with Erysipelas Bacterins Inactivated with Formalin and with Benzethonium

Seven swine immunized with Lot 9, Formalin-Inactivated Bacterin	Seventeen swine immunized with Lot 9, Benzethonium-Inactivated Bacterin	Thirteen swine remain as unimmunized controls
OOOO	OOOO	RRRR**
OOOO	OOOO	RRRr
RROO	OOOO	RRRR
OOOO	OOOO	RRRR
OOOO	OOOO	RRRR
OOOO	OOOO	RRRR
OOOO	OOOO	RRRr
	OOOO	RRRr
	OOOO	RRRR
	OOOO	RRRR
	OOOO	RRRR
	OOOO	OOOO
	OOOO	OOOO
	OOOO	
	OOOO	
	OOOO	

* = Resistance determined by skin scarification
**R = Severe reaction to challenge
r = Mild reaction to challenge
O = No reaction to challenge

TABLE 4

Comparative Immunity of Swine Following Immunization with Formalin and Benzethonium-Inactivated Erysipelas Bacterin

Period of Immunization	Percent of "R" Reactions Following Chalenge*		
	Benzethonium-Inactivated	Formalin-Inactivated	Control
2 weeks	0	7	79
4 weeks	1	14	86
11 weeks	9	27	100

*An "R" reaction is severe

phate and tested in mice as in experiment 2. It can be seen that both preparations have approximately the same immunogenicity and that under these conditions benzethonium did not improve the product (Table 5). It can, therefore, be assumed that benzethonium does not act as a superior adjuvant but rather, under the conditions employed here, it is capable of inactivating the culture with a minimum of antigen destruction. Apparently the benzethonium (1:10,000) is less destructive to antigen than formalin (0.4%). It was shown by Hausmann[1] that certain levels of formalin above 0.3% could damage the antigenicity of erysipelas.

TABLE 5

Antigenicity of a Formalin-Inactivated Culture with and without Benzethonium

Preparations	Surviving Mice/Total Mice Injected at Dilutions			
	1:80	1:240	1:720	Total
Formalin Alone	8/20	3/20	0/20	11/60
Formalin + Benzethonium	9/20	2/20	0/20	11/60

Additional studies indicate that the use of benzethonium as an improved inactivating agent has broad application. Work under way with *Leptospira pomona* bacterin has shown similar improvement in antigenicity with the use of benzethonium (1:10,000) in place of formalin (0.4%) as an inactivating agent.

Benzethonium chloride at a final concentration of 1:10,000 or greater was effective in killing *E. rhusiopathiae* within 90 hours. Comparison was made in mice and in pigs on the immunogenicity of erysipelas bacterin prepared with formalin and with benzethonium chloride. The immunogenicity of the benzethonium-prepared bacterins was found to be superior to that of formalin-prepared bacterins in every case in mice and in pigs. In experiment 2, it was shown that the benzethonium chloride-inactivated bacterin protected 59% of the mice immunized and challenged while the formalin-inactivated bacterin protected only 41%.

The superior antigenicity of the benzethonium chloride-inactivated culture was not due to an "adjuvant effect" of the benzethonium chloride but rather was due to less antigen destruction during the inactivation of culture.

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Medical Interchange

Notes and abstracts screened from the medical literature for their special interest to veterinarians by Lynn Stratton Morris.

Dangers of Molding Students into One Pattern

A story from the animal kingdom is used by Dr. Melvin A. Casberg in *The Journal of Medical Education* to illustrate the danger of attempting to mold all students into a single academic pattern. The objective in training physicians is not an assembly-line type of production.

It seems that the animals, in an effort to do something heroic to meet the problems of the new world, organized a school. Everybody had to take the same curriculum: running, swimming, climbing and flying.

The duck, an excellent swimmer, made only passing grades in flying and was very poor in running. He had to stay after school and also drop swimming to practice running. As a result, his web feet were badly worn and he wound up only an average swimmer.

The rabbit was at the head of the class in running, but had a nervous breakdown because of so much makeup work in swimming. The squirrel was excellent in climbing but developed frustration in the flying class, where his teacher insisted that he start from the ground up rather than from the treetop down.

The eagle was a problem child and was disciplined severely. In climbing class he beat all the others to the top of the tree, but insisted on using his own way to get there.

At the end of the year an abnormal eel that could swim well and also could run, climb and fly a little, had the highest average and was graduated with honors.

Med. News, 7:8 (March 24) 1961

Bacterial Invasion from Intestines

In experiments on rabbits and dogs, Dr. E. D. Frank and associates of Boston, Mass., found that Gram-positive bacteria can be grown from the mesenteric nodes and liver of the normal rabbit and dog. Gram-negative bacteria can be grown from these tissues of the normal dog, but not of the normal rabbit.

Gram-negative bacteria are found in the nodes and liver of the rabbit some hours after exposure of the rabbit to 2 hours of hemorrhagic shock. The incidence is higher 8 hours afterwards than it is 4 hours afterward.

These data confirm the view that bacteria are continuously invading from the

intestine. Exposure for 2 hours to hemorrhagic shock so weakens the antibacterial defense that Gram-negative as well as Gram-positive bacteria can be grown out more readily than in the normal animal. The number of bacteria that can be recovered, however, is judged too small to be a significant contribution to the endotoxemia of advanced hemorrhagic shock.

The investigators are associated with the Yamins and Kirstein Laboratories for Surgical Research, Beth Israel Hospital, Department of Surgery, Harvard Medical School, and the Harvard School of Dental Medicine.

Proc. Soc. Exp. Biol. Med., 106:396 (February) 1961.

Rapid Pre-Surgical Scrub Procedure

Preparation of the surgeon's hands for operating is very important for the patient and for the surgeon. It also is of some economic interest because of the number of man-hours devoted to the ritual of scrubbing up.

Dr. J. C. Scott of the Accident Service, Radcliffe Infirmary, Oxford, offers a technic that affords greater protection for the patient and takes only 1/10 as much time.

Since 1956, patients' skin has been prepared preoperatively with a 0.05% solution of chlorhexidine (Hibitane) in alcohol. In well over 1,000 cases this solution has given rise to no skin reactions and no evidence has been found that the solution is in any way less suitable or reliable than the iodine previously used.

The satisfactory results led the nursing staff and surgeons working with Dr. Scott on the emergency service to test a similar solution for preparing hands before operation. The solution used was 0.5% cetrimide (Cetavlon) and 0.05% chlorhexidine in 70% alcohol. When the method was first used, 153 broth cultures were made on 12 occasions from the hands of 14 of those working in the operating room. These cultures were taken from dry, "socially" clean hands before immersion in the solution, after immersion for 20 seconds in the solution and after gloves were removed at the end of the operation.

After immersion in chlorhexidine, 77.8% of the cultures grew no organisms, 16.6% grew nonpathogenic micrococci, and 5.6% grew aerobic spore-bearing bacilli. Organisms present on the hands before immersion in the solution included *Staph. aureus, Str. viridans, Str. hemolyticus, Proteus vulgaris* and paracolon bacteria. These never appeared in the cultures taken after immersion in the solution or when gloves were removed after operation, although micrococci usually grew in cultures taken after gloves were removed. No pathogenic organisms were grown.

After following this procedure for the past year, no member of the staff has shown sensitivity to the solution or irritation from it. There has been no evidence to suggest that the change has had anything but a good effect on the Infirmary's already low infection rate.

Dr. Scott concludes that there may be other solutions that will do the job equally well, "but the solution we have tried has met in all respects the demands made on it."

The Lancet, 1:1292 (June 10) 1961.

Glaucomatous Dogs Needed for Research

Glaucomatous dogs, particularly breeding stock of Wirehaired Terriers, Cocker Spaniels and Beagles, are being sought by the Department of Surgery, Yale University School of Medicine, New Haven 4, Conn.

Dr. Louise G. Lovekin offers to pay transportation charges on such animals. They would prefer to keep the dogs, but are willing to return them to their owners if desired.

In addition to conducting research on glaucoma in dogs, the scientists also are anxious to establish normal eye size for various breeds. Anyone able to send them eyes will be furnished with a supply of plastic shipping jars on request.

Gaines Dog Research Progress, Spring, 1961

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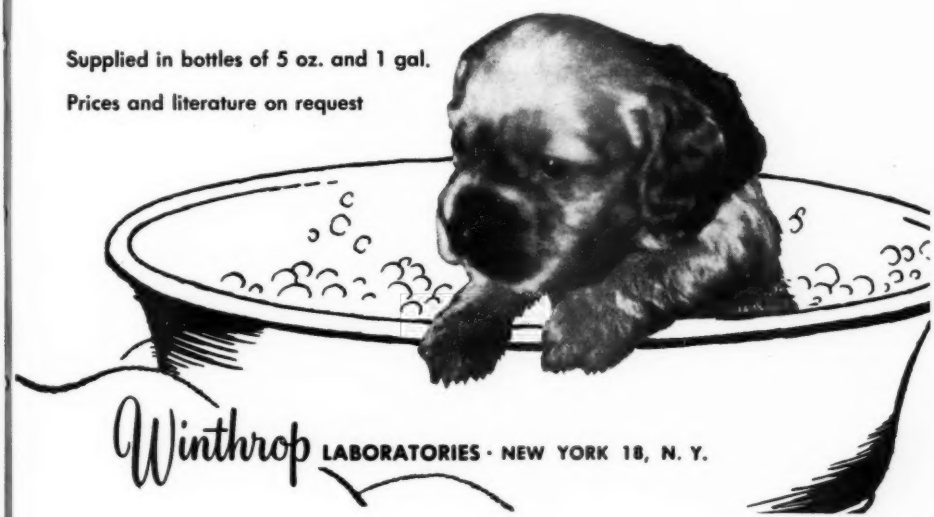

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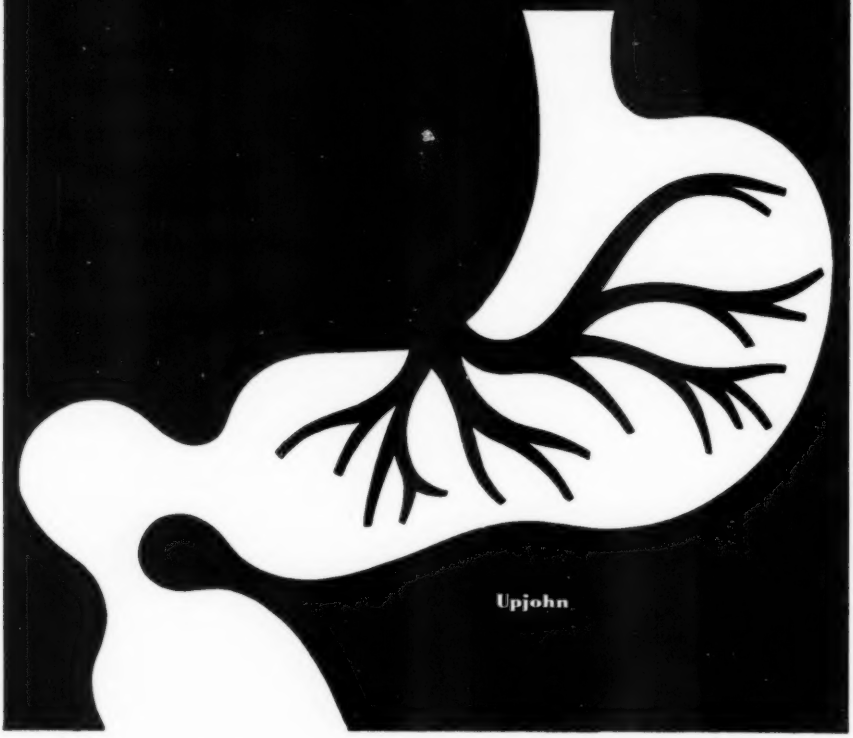

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